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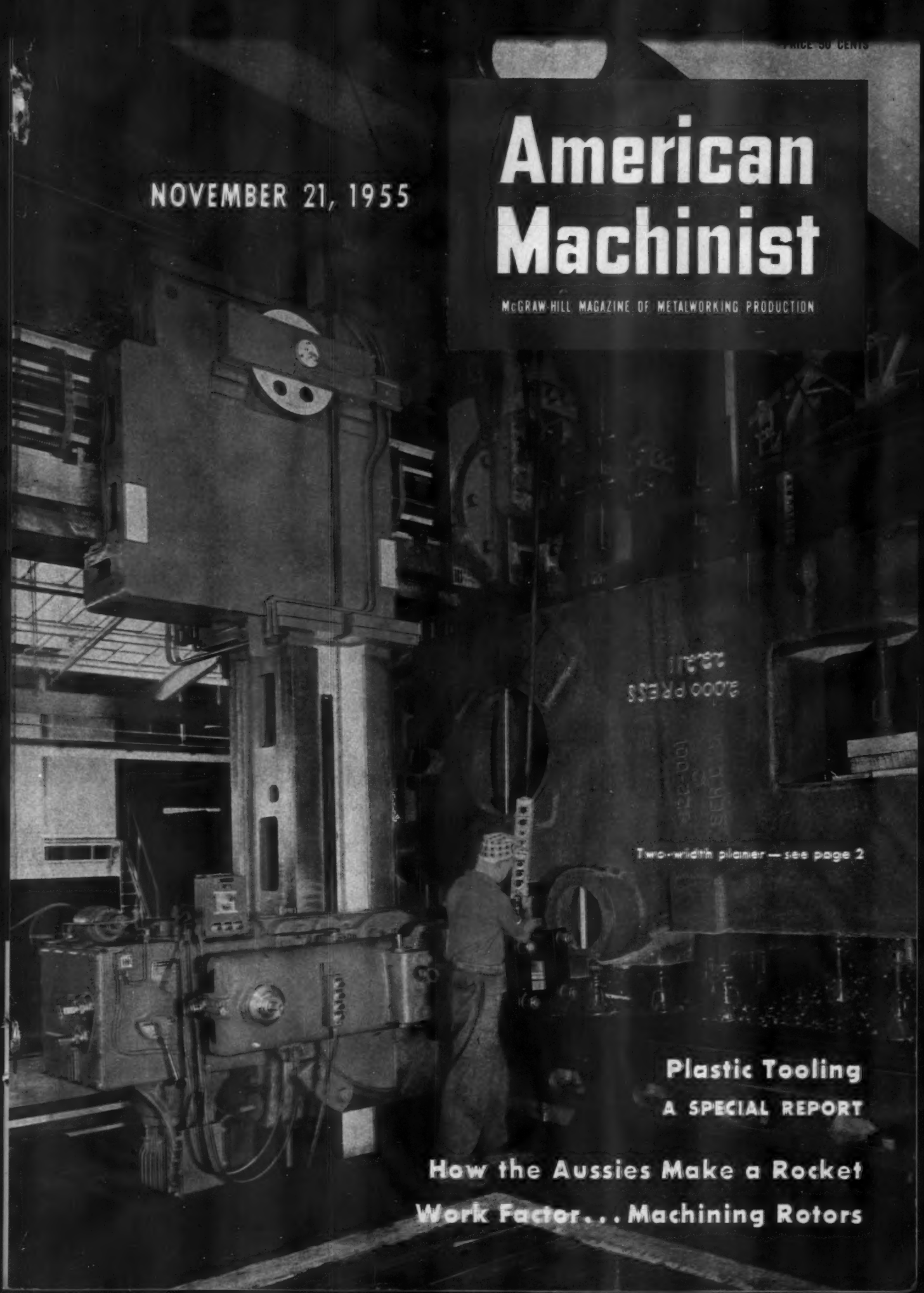
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

NOVEMBER 21, 1955



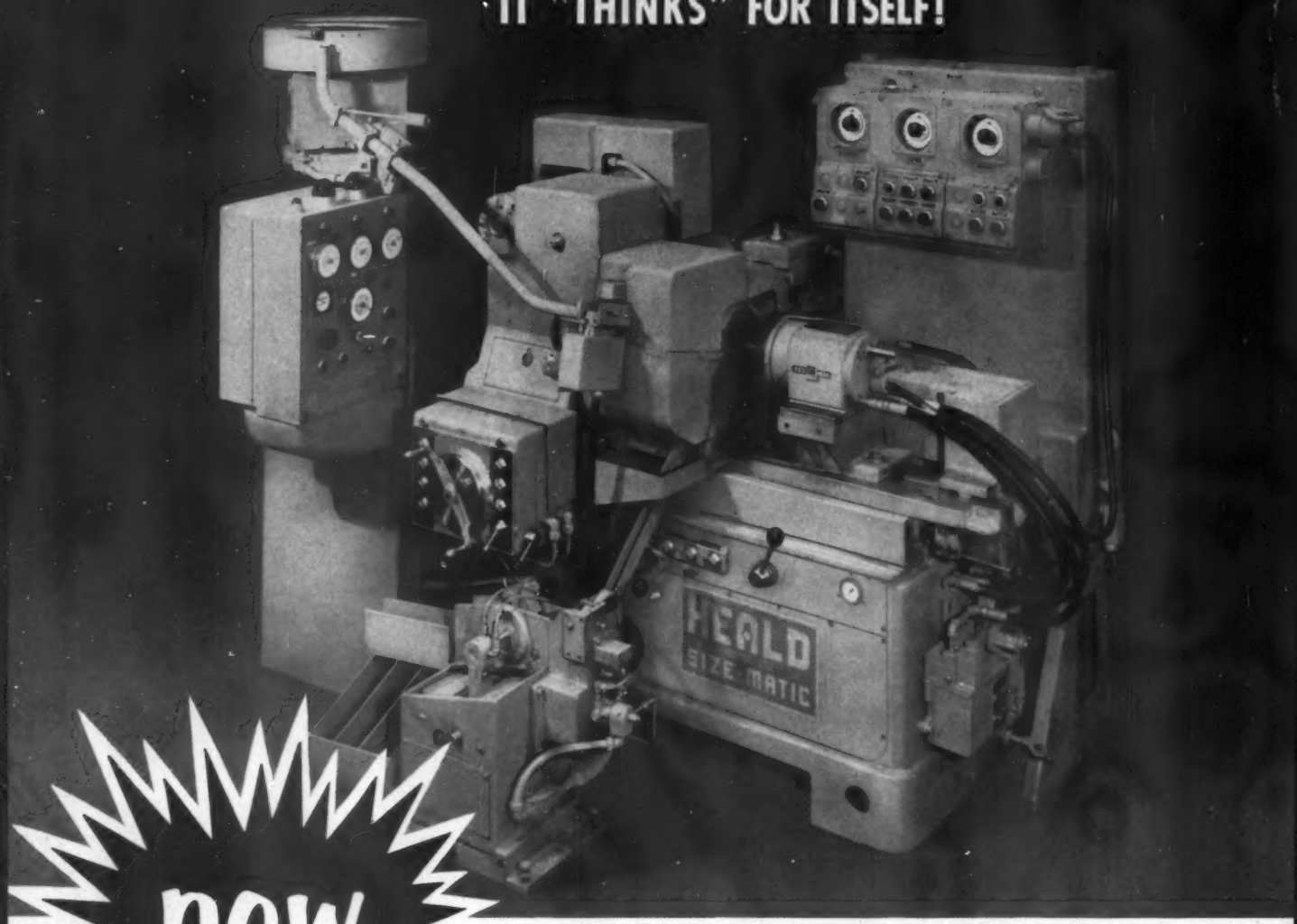
Two-width planer — see page 2

Plastic Tooling
A SPECIAL REPORT

How the Aussies Make a Rocket

Work Factor... Machining Rotors

IT "THINKS" FOR ITSELF!



new

HEALD MODEL 170 AUTOMATIC CHUCKER

with after-gaging and **FEEDBACK**
holds close size limits automatically

WHAT FEEDBACK MEANS TO YOU

The practical application of feedback to internal grinding and borizing equipment opens a new field for cutting production costs on long-run jobs.

A signal from the after-gaging unit is fed back to the tooling or diamond — automatically correcting any tendency to drift out of size. Feedback limits are well within specified tolerances of the work, thus making any needed corrections *before* parts reach scrap limits.

All this is done without any effort or attention on the part of the operator. That means higher productivity per man-hour — one operator can easily control a greater number of machines. It means that off-size scrap parts are virtually eliminated. It means higher sustained production, with greater accuracy and precision, at *lower cost per part.*

The new, completely automated Heald Model 170 Auto Chucking Size-Matic shown above makes short work of grinding a blind interrupted bore in valve tappet bodies.

With *automatic* hopper feed, orientation, chucking, cycling and unloading, a net production of 204 pieces per hour at 90% efficiency is consistently maintained. And with after-gaging and feedback, tolerances of .0003 on bore size, .00005 maximum out-of-roundness and .0001 maximum taper are easily held. Feedback enables the machine to detect tendencies toward errors—and correct them automatically, without operator attention.

This is Heald automation at work—bringing you higher production and greater precision than ever before. For the newest advances in internal grinding, rotary surface grinding and borizing — IT PAYS TO COME TO HEALD.

For information on the new 170 Size-Matic, send for Bulletin 2-170-A.

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Subsidiary of The Cincinnati Milling Machine Co.
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American Machinist

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NUMBER OF COPIES PRINTED THIS ISSUE 39,714

chips

EXPANSIVE . . . National Machinery Co, Tiffin, Ohio, has recently installed the adjustable-width double-housing planer on our cover. It can work pieces 23 ft wide, 15 ft high under the crossrail, and 24 ft long. But the table is only 12 ft wide (instead of 22 ft), and an auxiliary left-hand housing is adjustable from 13 to 23 ft. Any workpiece wider than 13 ft has the overhang carried, if necessary, on a buggy running on a rail. Two railheads, a sidehead on the right column, and one on the auxiliary housing can all work at the same time, machining three sides of the work instead of the usual two. And the piece can be anything up to the largest transportable on a flatcar. For details on the new machine, produced by Hamilton Division of Baldwin-Lima-Hamilton, see the description in "New Shop Equipment, Parts & Materials."

PLASTIC TOOLING . . . We've described, now and again, various plastic tooling, but we felt it was time to do a more comprehensive job. Associate Editor De Groat has combed the automotive industry for examples, and added to that a number of aircraft-industry examples. Result: Special Report.

MORE PLASTICS . . . One of the most difficult of forming operations on laminated plastics is the shaping of aircraft canopies without spoiling the optical properties. K W Taubert tells how Douglas Aircraft does it on the RB-66 canopies. . . . Also about aircraft tooling is the report on magnesium tooling plate at Republic Aircraft.

ROCKETS . . . Manufacturing information on American rockets is usually classified, so we went to Alicia Grobtuch, of our Australian World News Bureau, for a story on how they make 'em in Australia. Considerable ingenuity there replaced our heavily mechanized special equipment, so this story contains many ideas you can use.

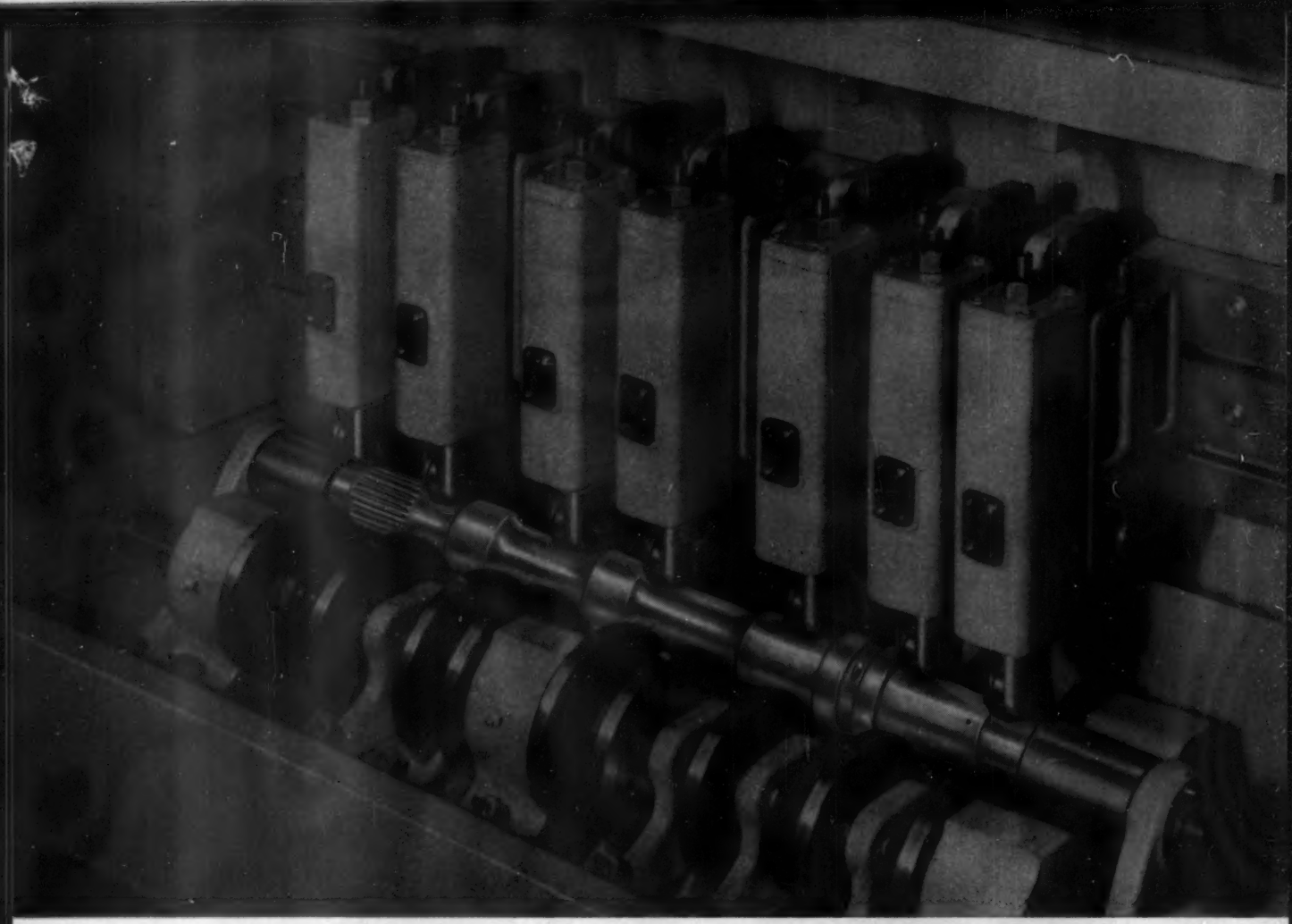
ELECTRONIC GAGING . . . David M Gaskill of Cleveland Instrument Co gives you a picture-and-caption story of a variety of applications of electronic gaging systems. It's compact and understandable.

WORK FACTOR . . . There has been much argument, pro and con, on incentives on delicate assembly jobs. So we provide four pages of pictures and captions from CBS Hytron to show analyses of electronic-tube assembly. Here's your chance to evaluate applicability in your own shop.

WEIRD ROTORS . . . Read Standard Corp makes queer-shaped interlocking-helical rotors for blowers. Many experts said they couldn't be machined. So Read worked out its own tooling and methods. In our lead article, Norris H Whisler (see biog) shows how its done.

COMING . . . *AM* for Dec 5 is a busy issue, with a Special Report on making pressformed parts from Greist Mfg Co (which went ahead supplying data to us with 18 in. of flood water in the pressroom), articles on predicting manufacturing costs, preset cutting tools, form-milling moly, home-made flame-hardening, scrap-strip layout, welding with CO_2, Soviet automation, and grinding carbides, plus several features and grinding in an automatic lathe for a cover.

NORRIS H WHISLER went to work at Hardinge Co, Inc, in York, Pa, when he was graduated from high school there in 1936. He went to Penn State Extension for 8 years studying ME and tool and die design nights while apprenticed during the day. He was loaned to Read Machinery Co in 1938 for assembly, later was foreman in the gun shop and torpedo line during WW II. In 1945-46 he was chief mechanic, Motor Corps, 2nd Armored Div. He became project engineer on the Standardaire blower, then plant supt on Sept 1, 1954. His explanation of tooling on the blower is our lead article.



How to eliminate *your* shaft distortion problems

Distortion during hardening is a major production problem.

The Gleason No. 140 Rolling Quench Machine corrects this difficulty, because the quenching and straightening operations are performed at the same time. Because cold straightening is eliminated, valuable production time and expense are saved, and the quenched parts have less residual stress.

Shafts cannot distort because they are rolled under pressure throughout the quenching operation. The operator puts the hot part on the lower rollers and starts the machine. From there on, the quenching operation is automatic. Rolling speed, pressure, and oil flow are pre-set to suit the work that is being quenched.

The automatic quenching cycle saves operator time, and gives *uniform* results for all parts quenched. The pre-set metallurgically correct oil flow gives uniform hardness.

The Gleason No. 140 Rolling Quench Machine is equally suited for small or large quantities. It accommodates shafts $\frac{5}{16}$" to 4" in diameter, 6" to 40" in length, with integral cams or shoulders up to 8" diameter. Tooling can be arranged to hold parts on diameters or centers. Unusual shapes can be handled with additional tooling. Write for further information.

The Gleason No. 140 Rolling Quench Machine also handles multiple quenching of short shafts.

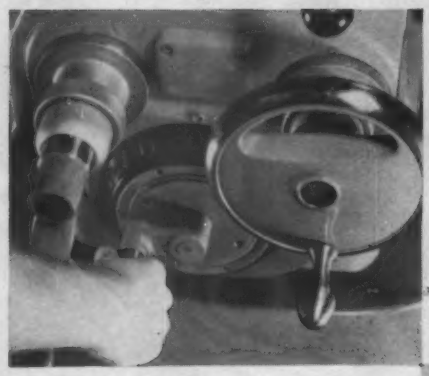
GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

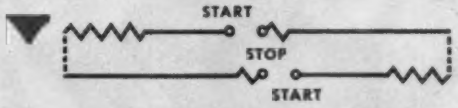
Have You Heard

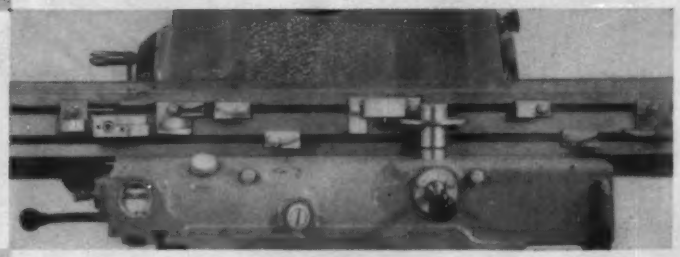
about the finest general

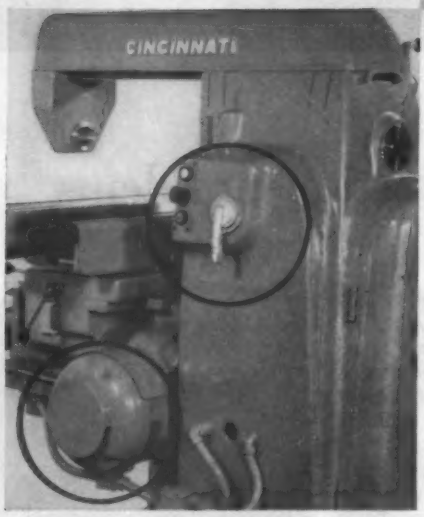


It's quick and easy to change feed rates. A single crank-type control, at the front of the knee, selects 16 feeds from ¼" to 30" per minute.

Automatic reciprocal milling setups, with center safety stop, may be assigned to Automatic Cycle Machines. That's because automatic backlash eliminator is a standard feature.







Electrical controls are built in, protected from dust and damage, and incorporate operator protection through interlocked disconnect switch. Individual motor for feed drive.

CINCINNATI ML and MI Milling Machines always were considered the finest equipment for toolroom work. Now they're better than ever before, and in addition, plain and vertical machines are available with or without automatic table cycles. And for a little more, automatic cycle machines can be equipped with automatic spindle stop. There you have the story in a nutshell.

Size, style and automatic features are related in the following manner:

New Nos. 2ML and 2MI Plain; built as toolroom millers, or as production millers with no loss of versatility. New Nos. 2ML and 2MI Universal; fine toolroom millers equipped with a new design Cincinnati Dividing Head (no automatic cycle). New No. 2MI Vertical; a toolroom miller, or production miller with no loss of versatility.

Three Cincinnati features of value in lowering your costs are illustrated here. Of course, there are many more, all of which are outlined in the new CINCINNATI 2ML and 2MI catalog, No. M-1916. Write for a copy, or telephone our nearest agent or office.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING

the Latest . . .
production ~~purpose~~ milling machines?

NEW
CINCINNATI
2MI
Plain Milling Machine

NEW
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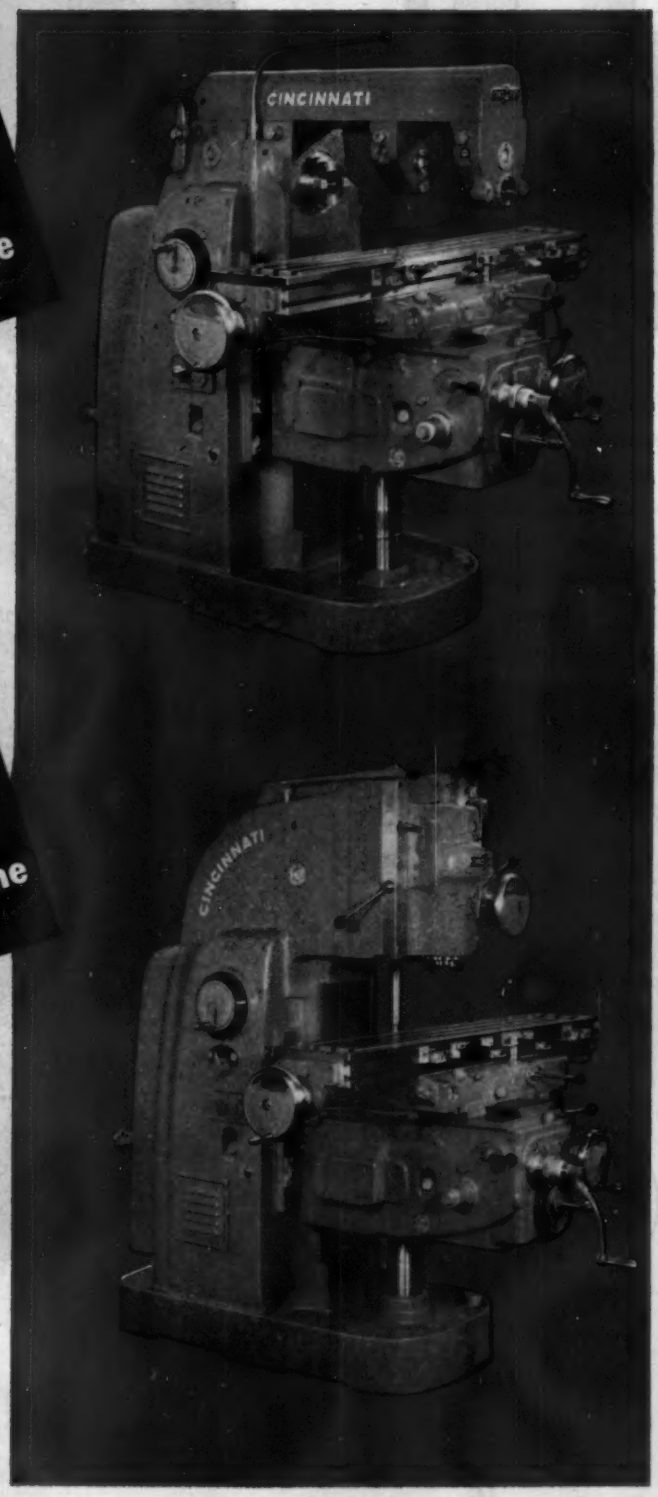
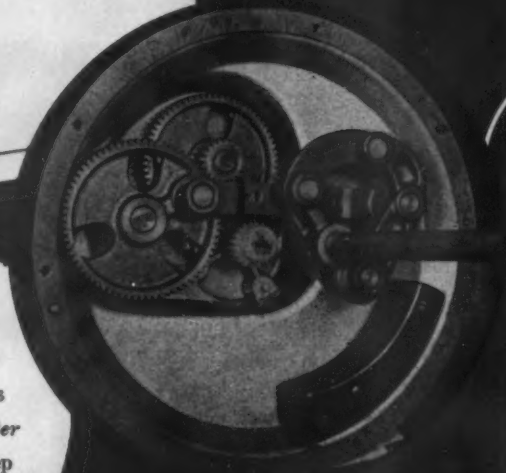
Vertical Milling Machine



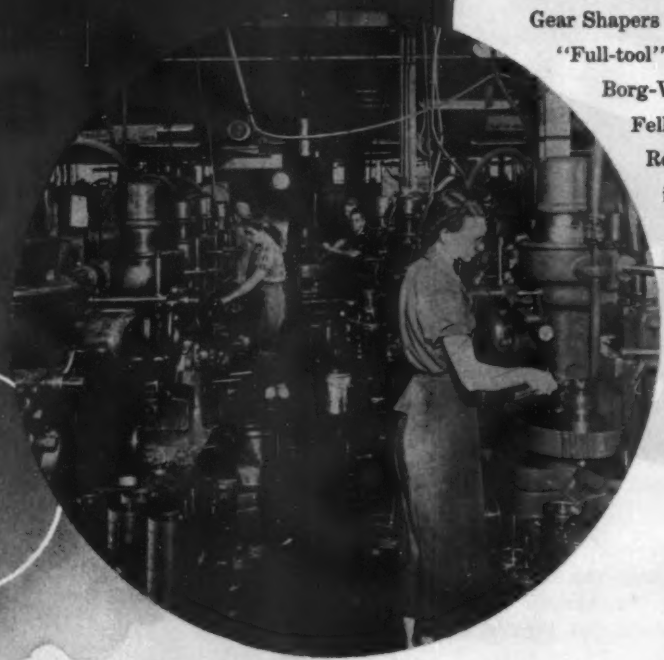
MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

NORGE



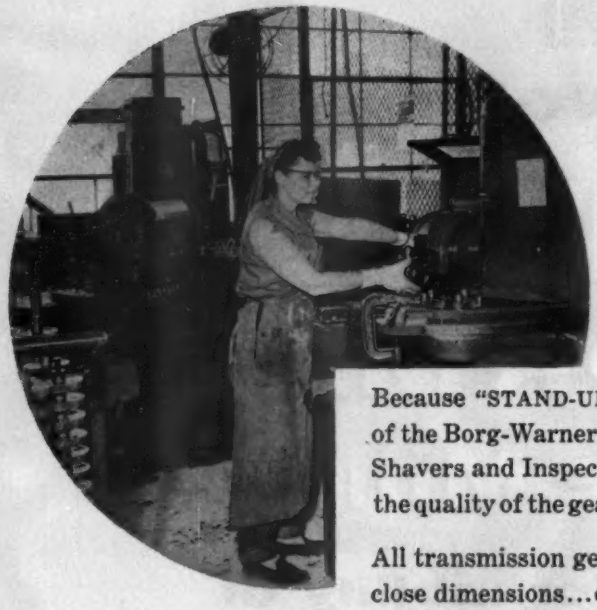
QUALITY of these transmission gears which drive the agitator keeps mechanical operation *quister* longer... helps to keep housewives sold on Norge.

QUALITY gears in quantity are economically produced by this battery of Fellows 7-Type Gear Shapers and No. 8 "Full-tool" Gear Shavers. Borg-Warner uses Fellows No. 8M Red Liner for inspection.



THE PRECISION LINE

SALES . . . . . *Borg-Warner cuts, shaves and inspects ALL gears by the Fellows Method*



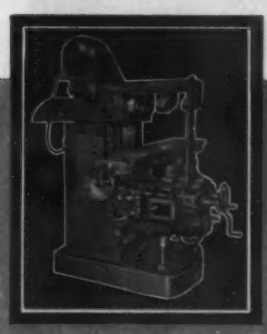
Because "STAND-UP" QUALITY builds reputation...Norge Division of the Borg-Warner Corporation selected Fellows Gear Shapers, Gear Shavers and Inspection Instruments to procure positive control over the quality of the gear trains in their "Time-Line" Automatic Washers.

All transmission gears that drive the agitator are cut and shaved to close dimensions...even the small nylon pinion is cut by the Fellows Method. Result: Norge's mechanical operation is quiet when the machine is new and stays quiet...and the housewife gets many extra Mondays of service life.

When looking for a better way to produce *quality gears in quantity* ...why not follow the example set by so many of America's Leading Manufacturers? Talk over your gear production problems with a Fellows Representative.

THE FELLOWS GEAR SHAPER CO.
***Head Office and Export Dept.*, 78 River St., Springfield, Vermont**
***Branch Offices:* 319 Fisher Building, Detroit 2**
5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*



Why Buy Two When

ONE VAN NORMAN Ram Type Miller

Gives You the Workability of Two Single-Purpose Machines

Increases Your Production...

Cuts Your Investment Costs!

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

No. 38M
one of 10 new Van Norman Ram Type Millers
TABLE SIZE: 64″ x 14″
CUTTERHEAD MOTOR: 10 HP
RAM MOVEMENT: 29″

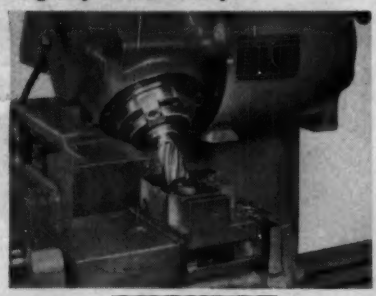
For the price of *one* Van Norman Ram Type Milling Machine without attachments, you get the workability of two single-purpose millers with attachments. This means you save on capital expenditures, yet do not cut down on production.

With the Van Norman Miller you do horizontal, vertical, as well as angular milling on one machine. The result — you keep the miller working at capacity every shift. You eliminate idle machine and worker time . . . increase production.

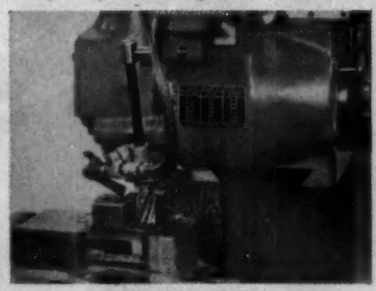
Ten new models with cutterhead motors ranging from 1½ HP to 10 HP and table sizes from 37½″ x 9³⁄₁₆″ to 64″ x 14″ give you a wide range of selection. Write for complete information, today.

HERE'S HOW IT WORKS

HORIZONTAL
A heavy horizontal milling cut performed on the miller. Over-arm and outer brace provide maximum rigidity and accuracy.



ANGULAR
An angular milling operation is being performed on a workpiece. Angular range of cutterhead is 0 degrees to 90 degrees. Accurate positioning is simplified by easy-to-read graduations.



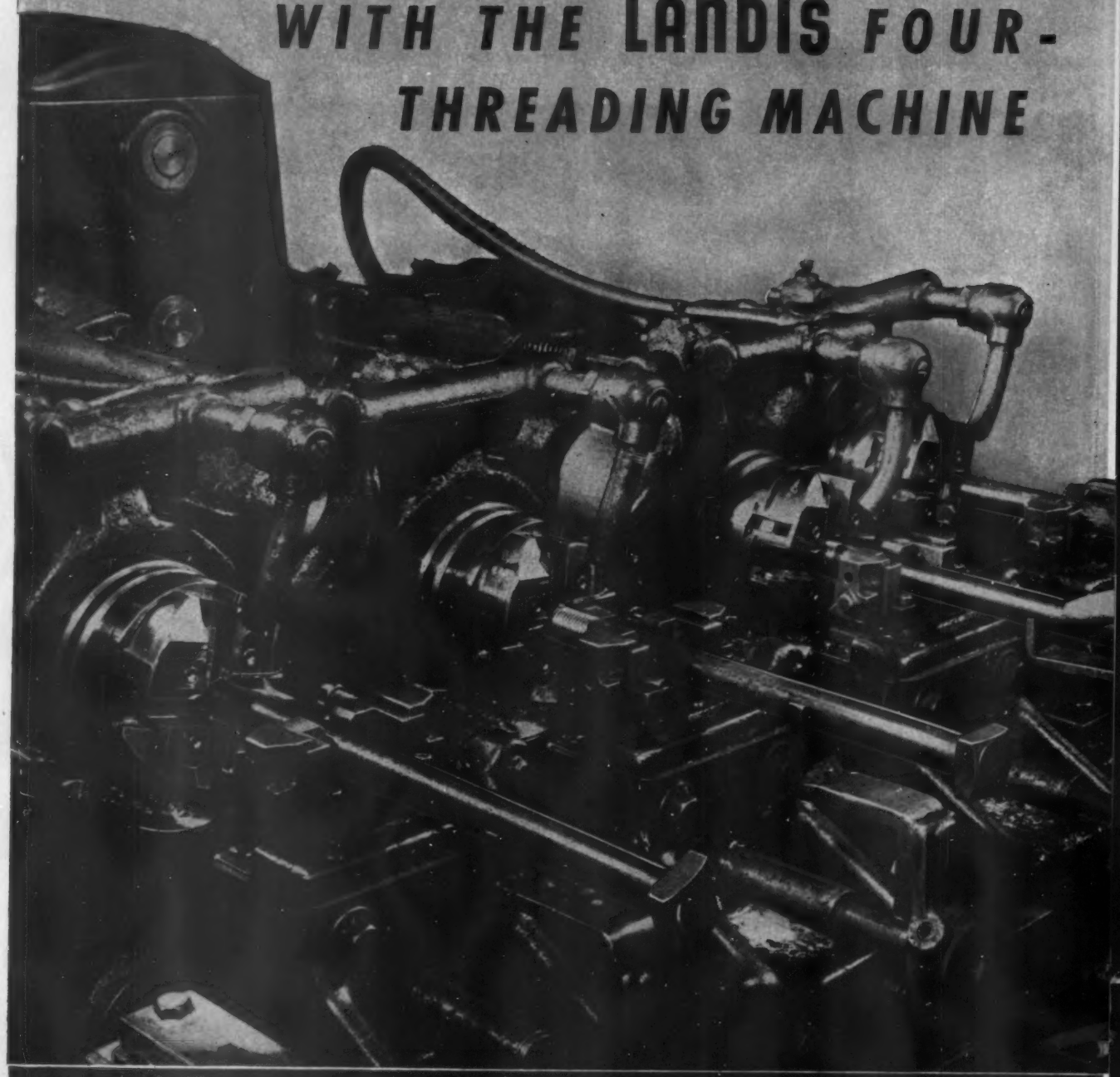
VERTICAL
With the cutterhead locked in the vertical position, a vertical milling operation is performed on the work piece.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

One Machine Bolt Threaded

WITH THE LANDIS FOUR-THREADING MACHINE



LANDIS *Machine* COMPANY

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD GENERATING EQUIPMENT

Every 4⅓ Seconds ! ! ! !

SPINDLE SEMI-AUTOMATIC

A single operator at the Pittsburgh Screw and Bolt Corporation produces an average output of 840 machine bolts per hour.

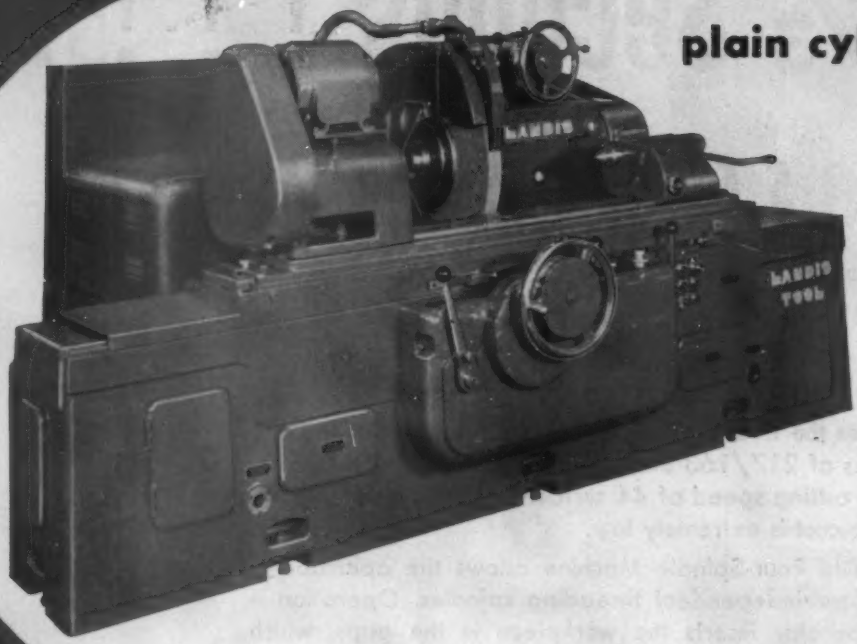
This operation requires the threading of 1" Square Head Machine Bolts from Commercial Steel blanks of 217/163 Brinnel hardness. 1" 8 pitch USS threads are cut 2¾" long at a cutting speed of 44 surface feet per minute. Production is continuous and chaser cost is extremely low.

The use of the *LANDIS* Four-Spindle Machine allows the operator to surpass the output of four independent threading spindles. Operation is semi-automatic—the operator inserts the workpiece in the grips, which open and close automatically, and removes it when threading is complete. The die head automatically feeds onto the workpiece, opens automatically and is automatically withdrawn at the point when the desired thread length is completed.

Send specifications when writing for Bulletin #E-88-1

WAYNESBORO
PENNSYLVANIA

Landis For Any



plain cylindrical grinders

A complete line for economical long or short runs. Swings available from 4" to 24", with lengths between centers from 18" to 240". Special tooling and hydraulic feeds for semi-automatic cycles also available.

centerless grinders

Two sizes made for thru feed or infeed grinding of straight or profiled work. Up to 6" diameter work and 10" wide wheels. A variety of tooling, loaders and feeds available for hand or automatic operation.

LANDIS TOOL COMPANY WAYNESBORO, PENNA., U. S. A.

Cylindrical Grinding Job

universal cylindrical grinders

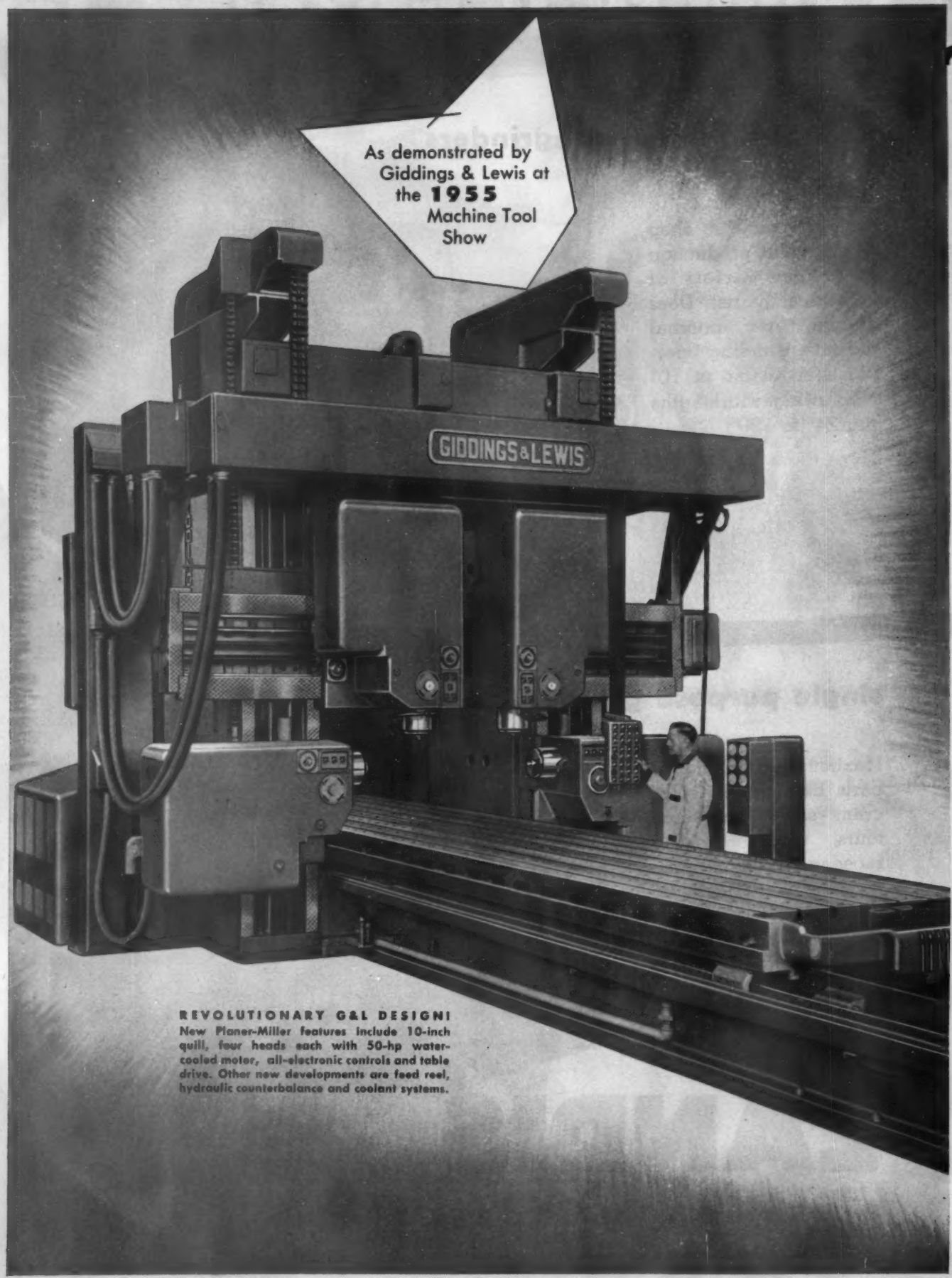
For tool room, job shop or moderate production on a wide variety of cylindrical parts. Does straight, taper, internal and face grinding operations. Available in 10" to 48" swings with lengths from 24" to 120".

single purpose grinders

Maximum production of parts like pistons, rolls, crank shafts, cam contours, valves, bearing races and jet engine components. Parts can be chucked or put between centers. Work handling can be built-in.

LANDIS

precision grinders



REVOLUTIONARY G&L DESIGN!
New Planer-Miller features include 10-inch quill, four heads each with 50-hp water-cooled motor, all-electronic controls and table drive. Other new developments are feed reel, hydraulic counterbalance and coolant systems.

NEW

Cool-headed Goliath...
master of low-cost production

Here's Giddings & Lewis all-new Hypro Planer-Miller... superbly engineered for high-speed, super-precision milling...years ahead in modern machine design

GIDDINGS & LEWIS offers you the world's finest 10-inch quill Hypro Planer-Miller—a 120-ton 72" x 72" x 24' giant of low-cost production. It's available with a wide variety of table and bed lengths and up to 144" width. Every principal machine component is designed to give you the ultimate in precision plane milling at high speeds. Revolutionary design features include:

MILLING HEADS—Each of four heads, powered by a 50-hp, 1800-rpm water-cooled motor, is provided with 24 spindle speeds in fine geometric progression from 9 to 500 rpm. Each head is equipped for "toe-in-or-toe-out" positioning for milling different types of steel alloys . . . or to accomplish special roughing or finishing operations. This feature also offers particular advantages for boring operations.

TABLE DRIVE—Because table drive is designed for practically zero backlash, it permits both climb and conventional milling with equal facility. New heavy-duty jaw clamp securely holds the table in position for cross-milling.

CONTROLS—All auxiliary functions of machine are electronically-controlled from permanent-type panel, and all operating functions from a traveling pendant station. Floor-mounted control station is for set-up purposes. Also, there are calibrating indicating instruments for direct reading of feeds in inches-per-minute and spindle hp consumption. Control is also provided for starting and stopping all service functions complete with indicating lights to show that these services are operating properly. Controls are properly interlocked so that duplicated control functions operate at only one station at a time.

FEED REEL SYSTEM—Giddings & Lewis' new feed reel system encloses all electrical, hydraulic and coolant facilities—usually found as collection of cables and wires around headstocks on conventional machines.

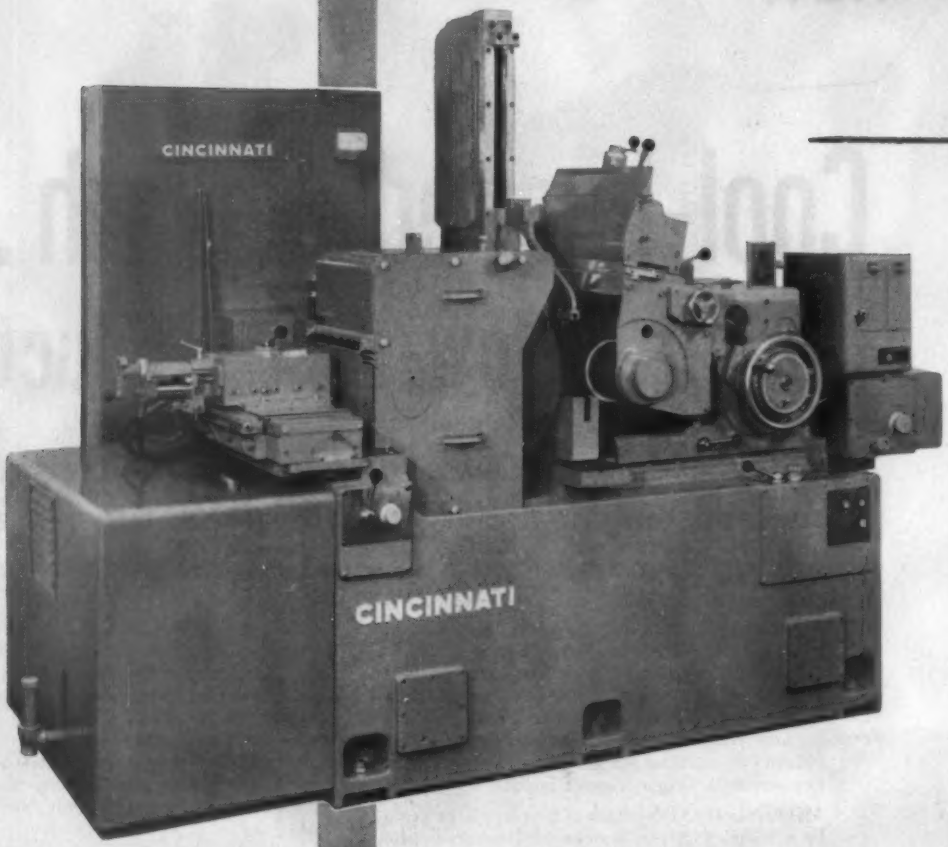
HYDRAULIC COUNTERBALANCE SYSTEM —An exclusive design by G&L, this new development plays an important part in flatness accuracy in milling with rail heads. It reduces to a minimum the wear between rail and headstock saddle. It also reduces appreciably the amount of power necessary to feed the heads and rail.

For complete specifications on the Giddings & Lewis new Hypro Planer-Millers, contact your nearest representative, or write—

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools—Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines; Vertical Boring Mills; Upright and Radial Drilling Machines; and Davis Boring and Cutting Tools.

For the



NEW
CINCINNATI FILMATIC
No. 3 CENTERLESS
GRINDING MACHINE
with high production equipment for infeed grinding

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

NEW CENTERLESS on your list..

Check These Cincinnati Advantages

1 FILMATIC Grinding Wheel Spindle Bearings . . . eliminate bearing maintenance . . . self-adjusting for rate of metal removal.

2 Pre-Loaded, Precision Ball Bearing Ways under Regulating Wheel Slide . . . virtually eliminates "stick-slip" . . . assures positive sizing adjustment in the smallest increments.

3 Power Operated Profile Grinding Wheel Truing Unit . . . with rapid traverse and truing rates in both directions.

4 Infinitely Variable Regulating Wheel Drive . . . any speed from 10 to 320 rpm quickly and easily selected at operator's normal working position . . . positive braking action.

5 21 types of cost-reducing attachments and extra equipment, including automatic grinding wheel balancing.

. . . all included in the NEW

Cincinnati Filmatic No. 3 Centerless Grinding Machine. Of course, there are many other new features and advantages that you will want to know more about, such as: stabilized infeed screw for preventing localized wear; positive lubrication of regulating wheel spindle bearings; controlled warm-up of bed casting, to maintain uniform work size as machine temperature increases. Catalog No. G-664 contains complete information. Write for a copy.

CINCI NATI

CINCINNATI GRINDERS INCORPORATED • CINCINNATI 9, OHIO

NOW!... Norton Offers Further Automation

in Cylindrical Grinding

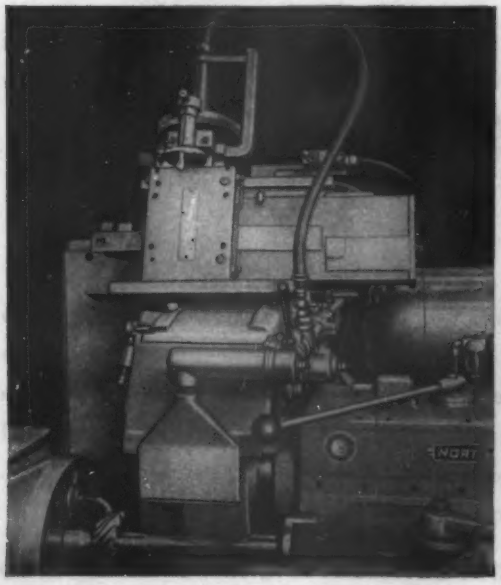
Automatic loading and wheel truing in Type CTU cut the time, work and costs of grinding small shafts.

Automation made one of its most spectacular advancements when Norton brought out the automated crankpin grinder — the sensational machine that adjusts, grinds, gauges and transfers entirely automatically.

Now Norton is happy to announce further news-making progress in this field. To cut the production time and costs of grinding small shafts, new Norton Type CTU Semiautomatic Cylindrical Grinders may now be equipped with automatic loading. Combining this new feature with automatic wheel guard type truing makes this machine fully automatic in operation.

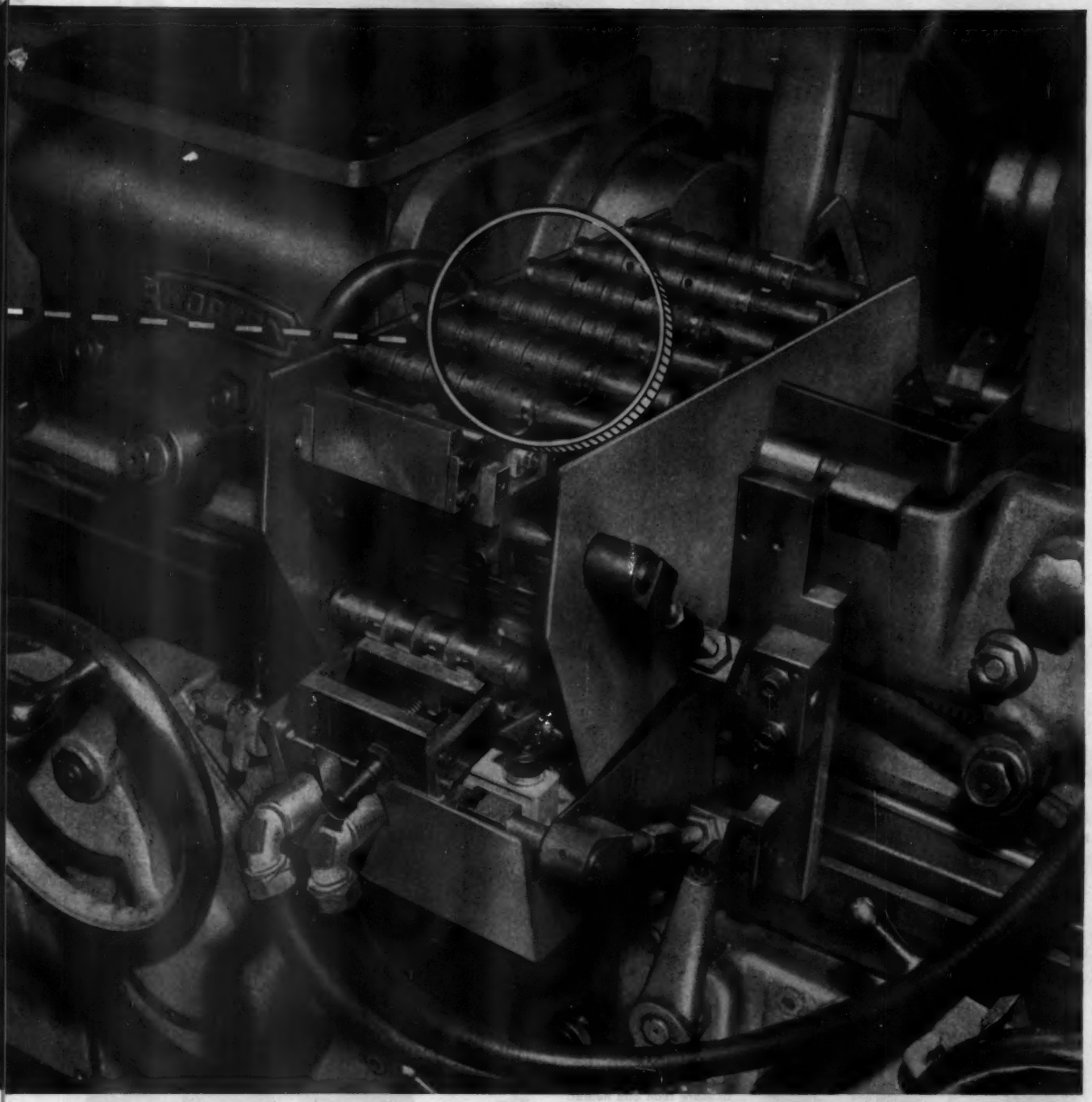
Thus the fastest, most economical and versatile grinding machine of its type is stepped up to new heights of efficiency.

Why not see your Norton Representatives for complete facts on how these and many other advanced features of the Type CTU grinder can benefit your own production? Or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" — to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



LESS TIME, WORK AND SKILL ARE NEEDED with the Norton wheel guard truing device, a feature of many types of Norton grinders. Shown here on the 10" Type CTU, it functions completely automatically whenever truing is necessary. In so doing it increases production, wheel life and diamond life.

This 10" Type CTU Semiautomatic Cylindrical Grinding Machine, and the 6" size, are now available for automation with Norton-engineered automatic loading and wheel truing advancements.



ANOTHER NORTON MILESTONE IN AUTOMATION. This automatic loading device, latest Norton development for 6" and 10" Type CTU Semiautomatic Cylindrical Grinders, speeds the production and cuts the unit costs of grinding small shafts. Its steadily paced, automatic operation enables a single operator to tend a battery of machines.

The device is adaptable to a variety of these parts, which are rolled by gravity on inclined rails. Latches between the rails separate the shafts and are arranged to release only a single workpiece at a time to the turret, which is carried on a hydraulically controlled swinging arm.

When the workpiece rolls into the turret the arm swings the turret to locate the piece in line with the work centers. As these move forward they raise the workpiece just enough to clear the turret's supporting fingers and permit free rotation.

After grinding — electrically timed — the turret is swung upward. A latch indexes the turret so that the work rolls onto the unloading rails. The turret continues its upward motion to the loading position and receives the next workpiece.

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Worth Looking At!

Kearney & Trecker's

NEW RAM HEAD

plain and universal milling machines

KEARNEY & TRECKER'S new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

The Ram Head machines are available with a choice of three heads — Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.*

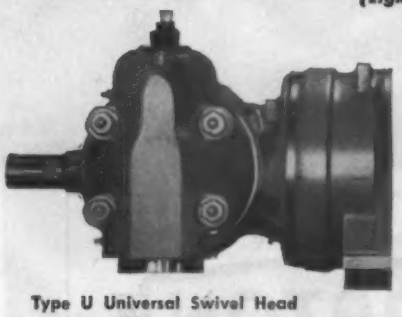
Ram Head machines are highly versatile and exceptionally economical for general purpose production milling. They are built in Model CH, CK and CSM designs with 69 different machines in sizes from No. 2 to No. 4 in both plain and universal styles. Machines may be equipped with either Standard Directional Table Control, or Mono-Lever and Automatic Cycle Table Control.

To afford greater versatility with minimum maintenance, the Ram Head is individually motor-driven . . . has its own lubrication system and speed change mechanism. When used as a standard horizontal machine, the ram acts as a heavy-duty arbor support.

For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

with choice of three types of heads

(Eight spindle speeds in three optional ranges)

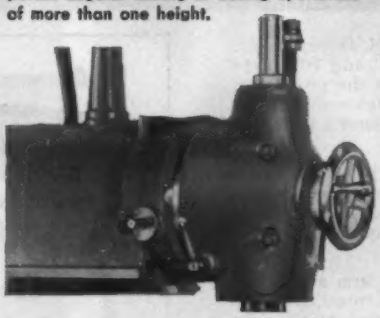


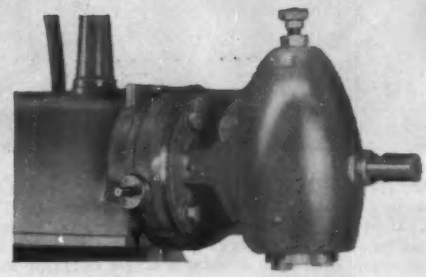
Type U Universal Swivel Head

Capable of numerous milling combinations, this Universal Swivel Head has two graduated bases at right angles to each other, both of which can be swiveled through 360 degrees. Head is rotated by worm and worm wheel with adjustment by hand crank.

Type Q Adjustable Quill Swivel Head

Spindle can be set at any angle through 360 degrees. This Ram Head has a 3½" hand-feed quill movement. In addition, four-position micrometer stop and dial indicator permit angular milling or boring operations of more than one height.





Type V Vertical Swivel Head

Especially adapted for vertical and angular milling operations. Spindle housing base of Vertical Swivel Head is graduated. Spindle can be set at any angle up to 360 degrees.

Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN

20/10hp No. 3 Model CSM, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

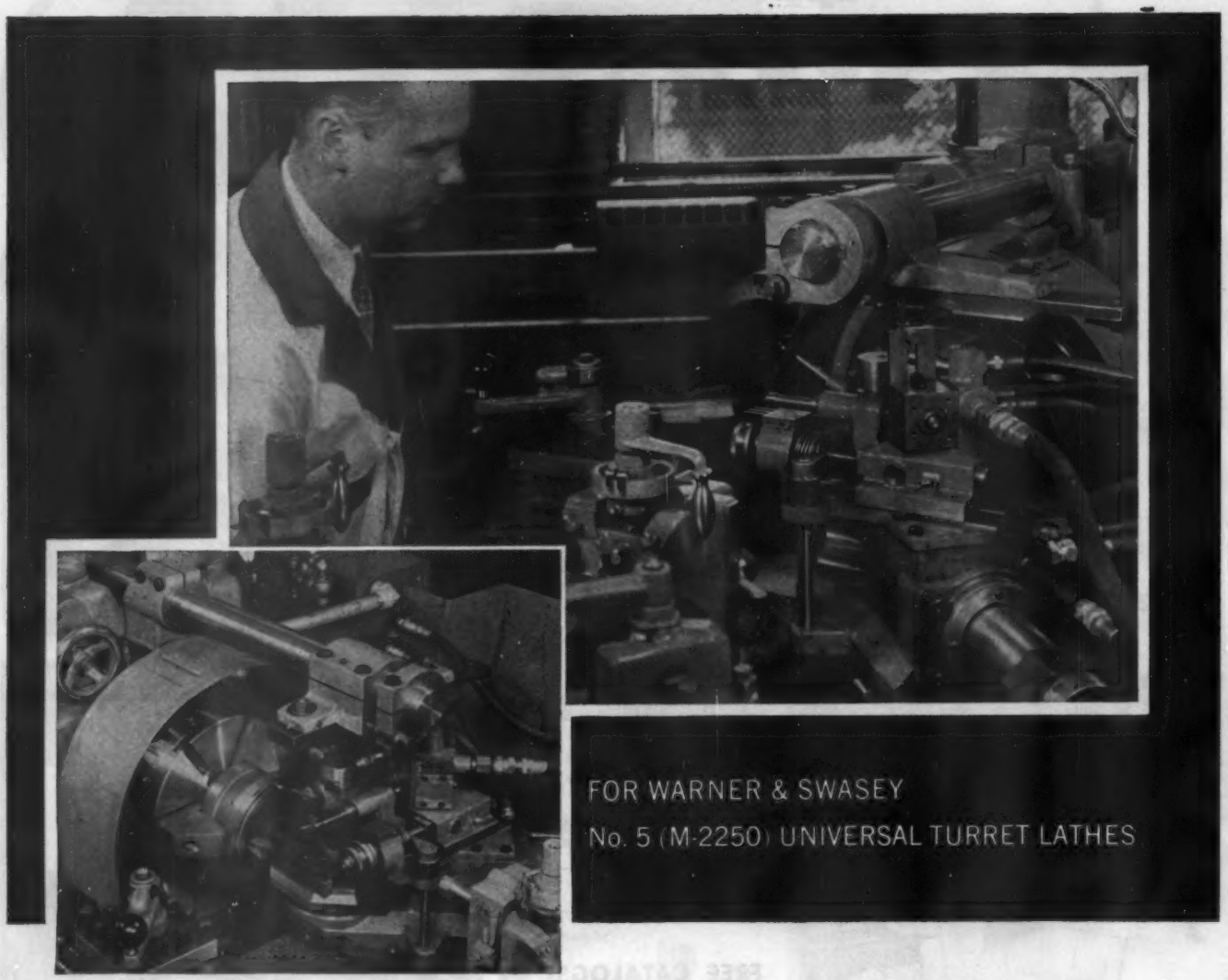
available for **TOOL-LEASE**

FREE CATALOGS!

Ask for catalog No. RH-10A for complete data on Ram Head plain and universal milling machines, and Tool-Lease bulletin, TL-10A. Also see our catalog in SWEET'S.

7½ hp No. 3 Model CH, Universal style Ram Head milling machine with standard Directional Table control and Type U Universal Head.

TWO NEW CONTOUR WARNER & SWASEY



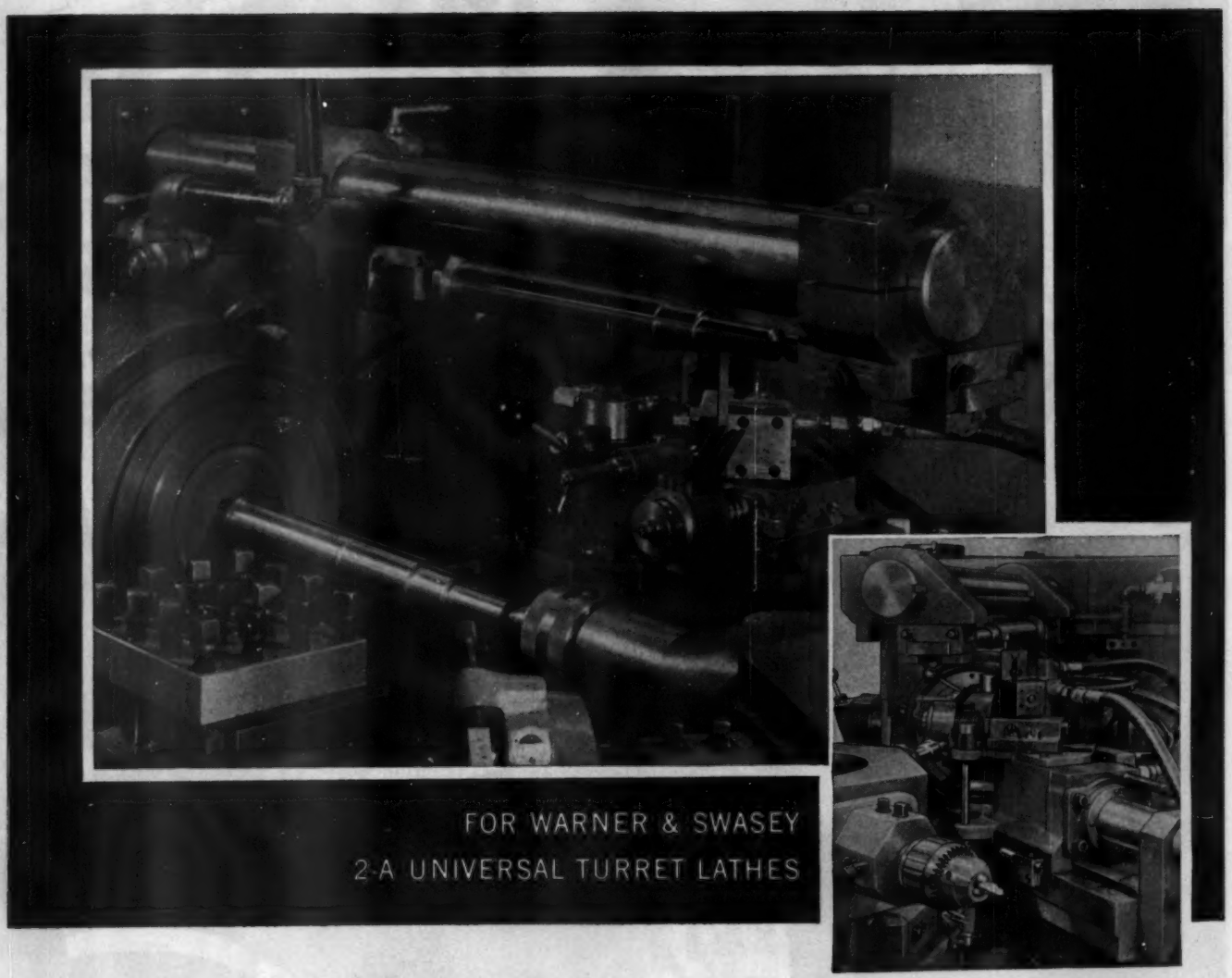
FOR WARNER & SWASEY
No. 5 (M-2250) UNIVERSAL TURRET LATHES

Fast, Accurate Contour Turning and Facing. Curves, tapers and radii can now be machined in less time with simpler, less expensive tooling. Even both sides of the spindle center can be machined when contour facing. Low setup time means you can profitably run small as well as large lots.

Retains Turret Lathe Flexibility. Hydraulic tracer unit is mounted at the rear so additional operations can be performed from both hex and square turrets on contouring setup. Eliminates many secondary turning operations. When not in use, normal turret lathe work can be performed.

Separate Rough and Finish Contour Cutters. Manually controlled, hydraulically operated, two-position tool turret for rough and finish cutters. Cutters can be easily set to finish size by a micrometer adjusting screw with easy-to-read dial. It has 3 leaf-type stops which permit up to 4 roughing cuts to be taken prior to finish cut without adjustment or changing cutter settings.

ATTACHMENTS FOR TURRET LATHES



FOR WARNER & SWASEY
2-A UNIVERSAL TURRET LATHES

Adjustable and Accessible Template Mounting —uses flat templates for facing, and first piece or flat templates for turning. Templates are mounted on a rigid overhead support. Micrometer screws are provided for fast, accurate template adjustment for faster setup.

Instantaneous Tool Slide Response. Tracer slide is actuated by a powerful, direct-acting hydraulic cylinder with a long piston stroke. Extremely sensitive tracer slide response assures accurate reproduction of the template form. Metal removal rate is limited only by the cutter used.

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BETTER, FASTER,
FOR LESS
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1880 — 1955

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NOW...more than ever

MORSE

means

"THE MOST"

in cutting tools

New Fosdick Layout Machine does

The new Fosdick Sensitive Radial Layout Machine combines a high-precision jig borer table with our sensitive radial drill.

Table gives cross movement.

Vee and flat construction with precision screw in center of vee insures easy, precise movement through full 18" of travel. Graduated dial shows thousandths. A scale is included for rough measurements. Rapid traverse is available.

Head is traversed for length movement.

Roller bearings support weight of head on hardened steel ways. Total length of travel, 34". Measurements are made by graduated dial on traverse bracket. Head rapid traverse is also available.

Vertical adjustment of table by power.

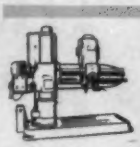
Vertical adjustment, 16½". Maximum distance from spindle to table top, 23".

Other features

One-piece column construction, 12" diameter. Fixed-height arm swings 360° around column. Arm and column clamps hold accurate position while drilling. Direct-reading feed and speed selecting levers. Safety feed clutch. 3 hp motor. Nine spindle speeds, 60 to 1200 rpm or 175 to 3500 rpm. Four spindle feeds, .004" to .020" or .002" to .010" per revolution.

Use it also as a Radial Drill!

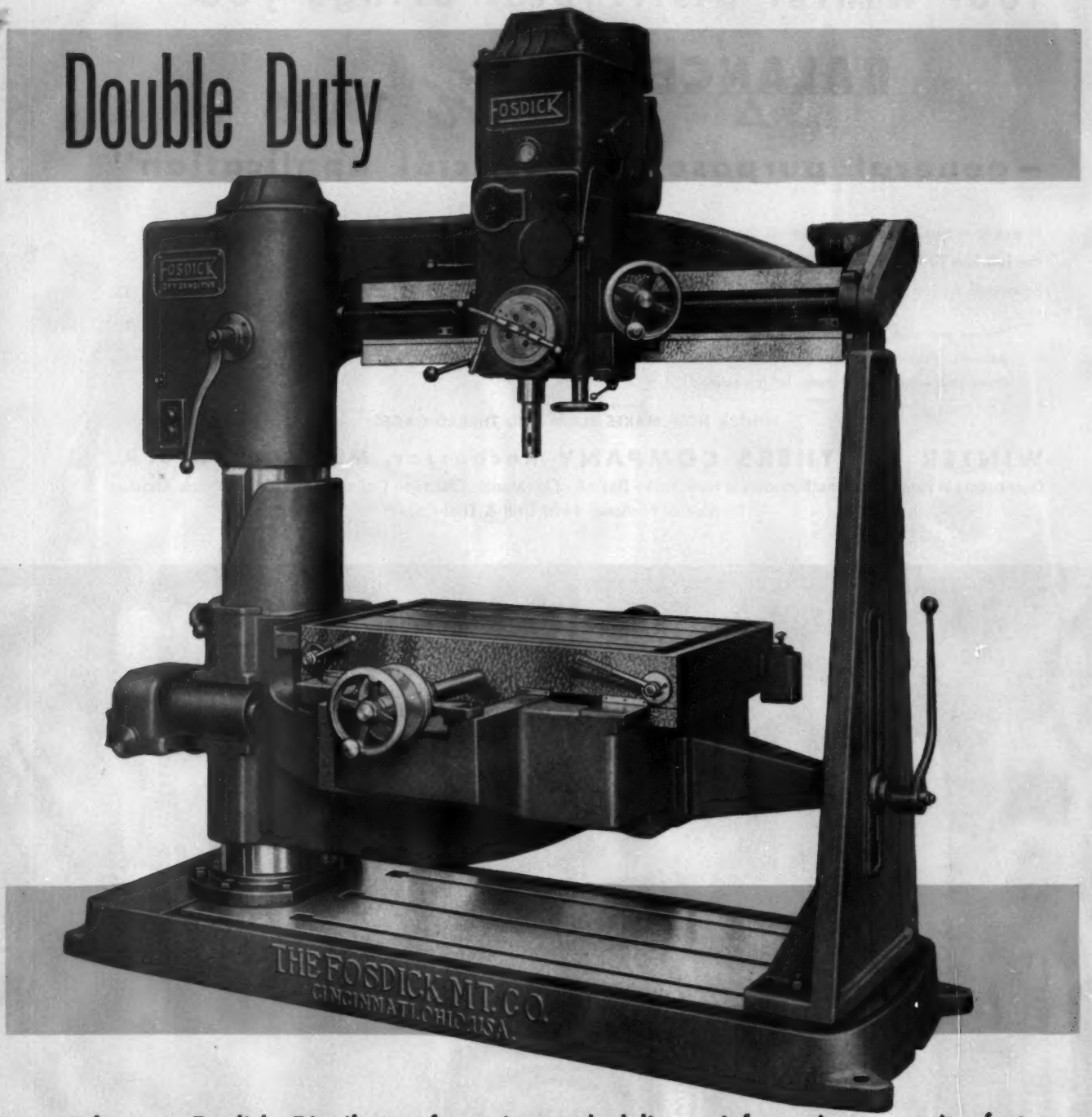
Simply remove the filler block between end of arm and outboard support and your Layout Machine becomes a Radial Drill! Work can then be mounted on the adjustable table and position reached by swinging arm and moving head. To drill large work pieces *entire* outboard support can be easily removed.



Fosmatic Radial Drills

Jig Borers

Double Duty



Ask your Fosdick Distributor for price and delivery information or write factory.

Need Drilling Equipment? Get a Proposal from Fosdick!

Sensitive and Upright Drills

Sensitive Radial Drills

Jig Grinders

Automatic Positioning Jig Borers

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THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

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Painstaking care by the cutting tool manufacturer in design, processing, and metallurgy makes good cutting edges. With reasonable care by your operator, good cutting edges *stay good* . . . You can rely on National tools to *make good* in stamina and long life.

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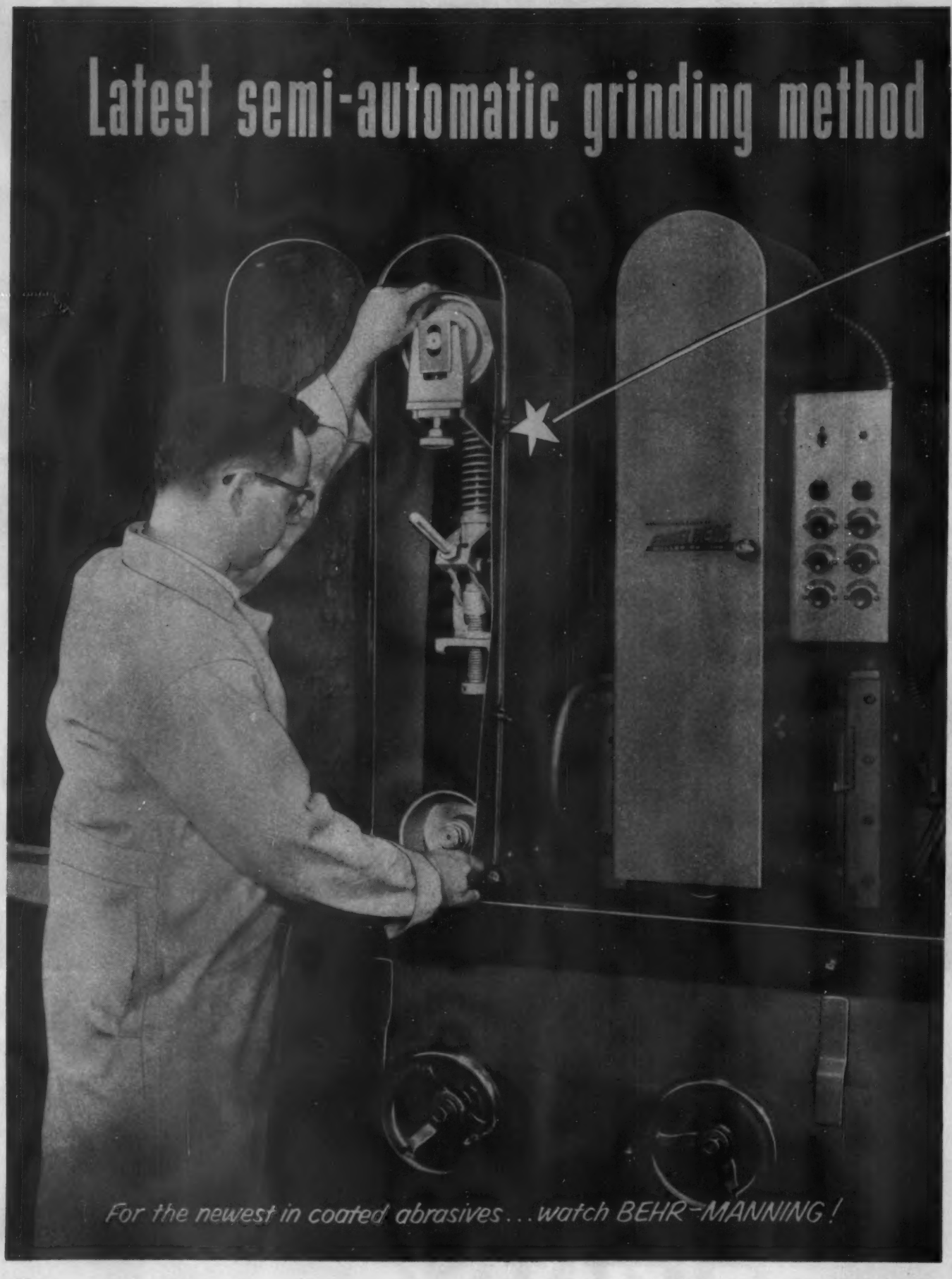
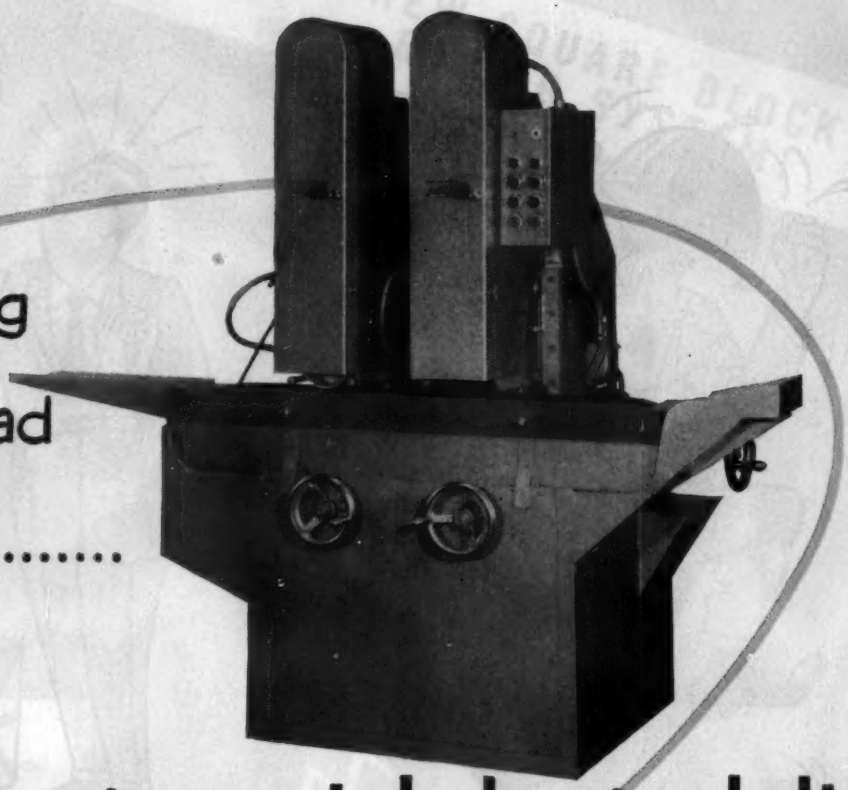
Latest semi-automatic grinding method



For the newest in coated abrasives . . . watch BEHR-MANNING !

.....with the Engelberg multi-head machine.....



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Here is another modern coated abrasive belt application that's answering industry's demands for increased grinding and polishing production. The conveyor-type Engelberg grinder rolls out flat surface pieces at record-breaking speeds . . . eliminates fixtures . . . and greatly reduces costly set-up time. BEHR-MANNING abrasive belts, smooth the way to superior operations, whether it's rapid stock removal while grinding, or superfine finishes during polishing.

Your finishing operations might require an entirely different abrasive belt application. If so, check with your nearest BEHR-MANNING Demonstration Room for the latest time-saving method. Call your local BEHR-MANNING Representative, or write direct to Behr-Manning, Troy, N. Y., Dept. AM-11.

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New—
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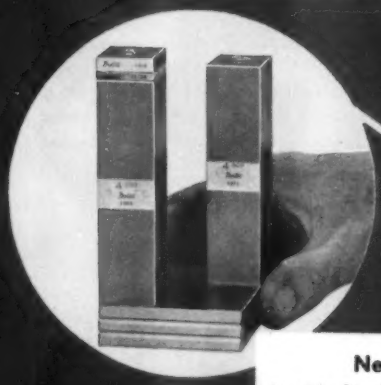

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Accuracy of gage block calibration depends upon *surface finish!* New DoALL Square Blocks have the finest finish of any in the world—0.6 micro-inches R.M.S. or better! Calibration error is reduced to a new minimum for commercial gage blocks.

To preserve and make full use of this superior accuracy, DoALL has developed completely new and different accessories. The combination sets an entirely new standard for precision gaging.

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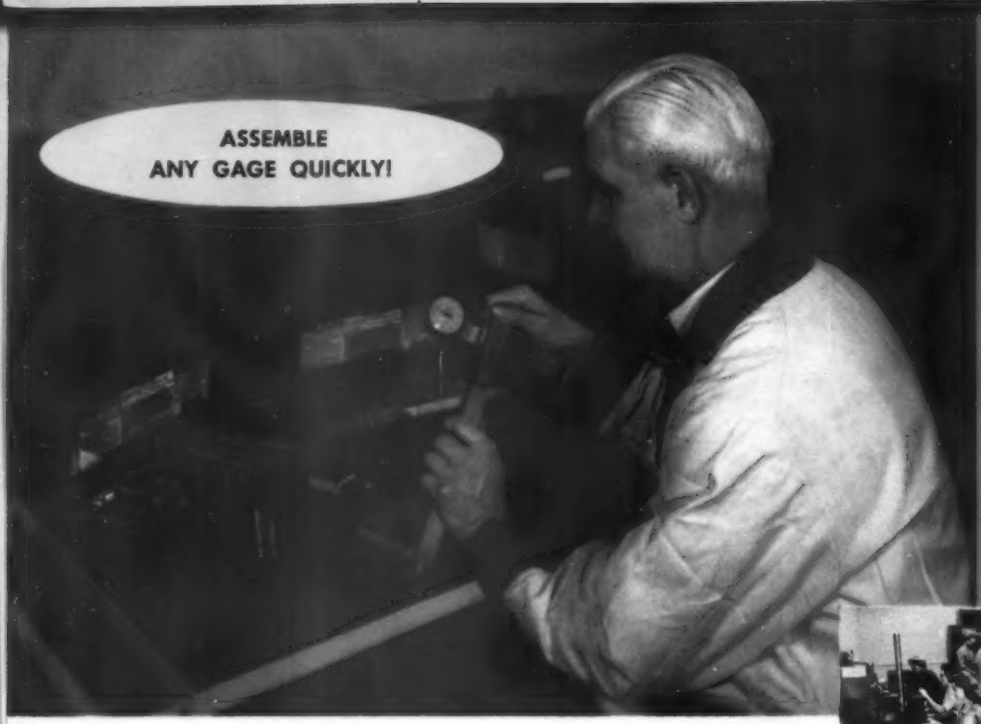

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ELIMINATES "FEEL".

In precision measurement in the range of 1/10000 inch, the human sense of "feel" fails. Now, DoALL offers universal dial indicator sets for use with any make of square blocks to eliminate human error.

MANUFACTURED BY DoALL in an entirely new, air conditioned and magnificently equipped gage laboratory. View shows lapping according to a DoALL-developed probability formula. Three-color interferometry is used at DoALL to calibrate Master blocks.

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With new ultra-accurate DoALL Square Blocks and new versatile accessories, you can make thousands of precision gages quickly at a fraction of the cost of special gages . . . use them in the inspection department, in the toolroom *and in the shop* . . . get greater dimensional accuracy, prevent costly errors. Why be satisfied with less? The cost per gage is low—blocks incur very little wear when used with DoALL Accessories.

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See a DoALL Square Block Gaging demonstration at your own plant, free of charge and without obligation. Compare them, try them, judge for yourself. Call your local DoALL Store or write: The DoALL Company, Des Plaines, Illinois.

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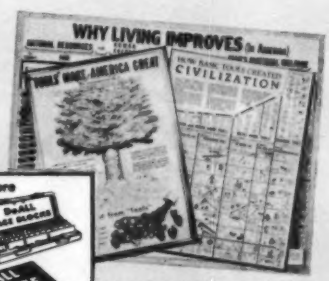

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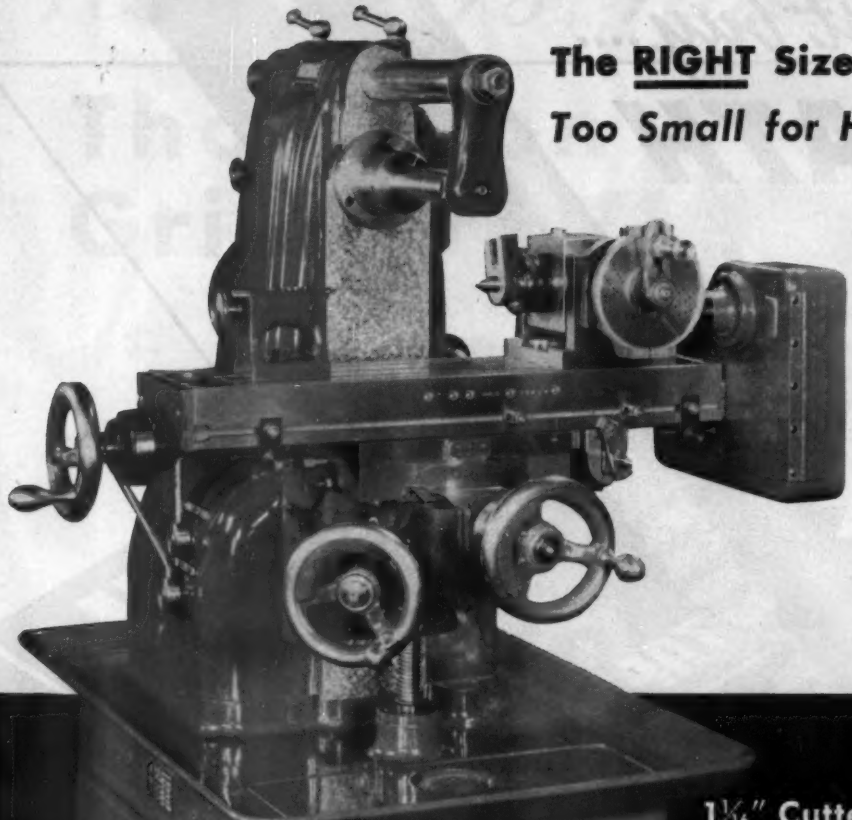
High Speed Precision
MILLING MACHINES



The RIGHT Size For Work Which is
Too Small for Heavy Duty Millers.

Advantages

- Saves Production Time
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1 1/16" Cutter Spindle Capacity
with 5C Round Hardinge Collet
Eight Spindle Speeds —
110 to 1850 R.P.M.

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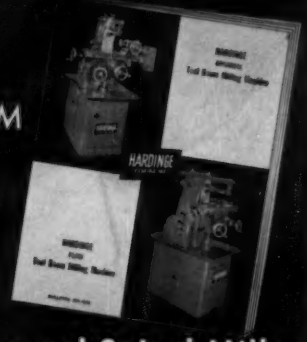

Model UM Universal Spiral Miller
Model TM Universal Plain Miller

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PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

New 6" x 18" hand feed

Thompson Grinder

FOR SHOPWORK OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

ONLY
$2,500*

PRECISION PETE says:

FOR LOW COST AND QUALITY YOU JUST CAN'T BEAT THOMPSON
Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

* Price F.O.B. Springfield, Ohio U.S.A., Subject to Change Without Notice.

Call, write or wire today

Thompson Grinders

The Thompson Grinder Company at Springfield, Ohio

Get **more parts** per hour

Look how MX has increased production and increased tool life on these typical screw machine parts

part	stock size	machine	operations	comparative performance				
				grade	SFM	seconds per part	production increase	tool life increase
DRUM NUT	⅝" round	Acme Gridley	drill rough form turn break down tap finish form cut off	B-1113	285	3.17	....	....
				MX	345	2.86	11%	87%
SHAFT	¼" round	Brown & Sharpe #00	rough form finish form ream turn cut off	B-1113	255	7.0	....	....
				MX	277	4.5	55.6%	30%
WASHER	¾" round	Brown & Sharpe	drill ream cut off	B-1113	172	14.2	....	....
				MX	250	10.0	42.5%	100%
PULLEY	1⅜" round	Brown & Sharpe G-2	center drill recess, drill tap thread form face cut off	B-1113	245	35	....	....
				MX	312	27.5	27%	25%

and longer tool life ...do the job with MX

the freer-machining screw stock

Make a note of this: USS Free-Machining MX Steels *have been successfully machined at speeds approaching 350 SFM.*

A broad appraisal of all screw machine operations shows that the *average* speeds used are under 250 SFM and that only a small percentage of parts are machined at speeds in excess of 300 SFM.

So unless you are operating at the highest speeds—and comparatively few shops are—you simply don't need and can't take advantage of any greater machinability than MX offers.

Remember that USS Free-Machining MX is designed to ensure *maximum* cutting speeds compatible with *economical* tool life. And it does. Wherever fast-cutting MX is put to work, production goes up and costs come down. From results obtained in shops that have used MX in more than a billion parts of many different kinds, we feel sure that MX will cut the cost of *any* part you now machine from ordinary screw stock. It does this in four ways.

By increasing the rate of production, *MX lowers the cost per part.* By prolonging tool life, *MX reduces down time.* By assuring better part finish, *MX often eliminates extra finishing operations.* By providing closer dimensional accuracy, *MX helps to minimize rejections.* In short, USS Free-Machining MX offers you greater economy and greater efficiency in your machining operations.

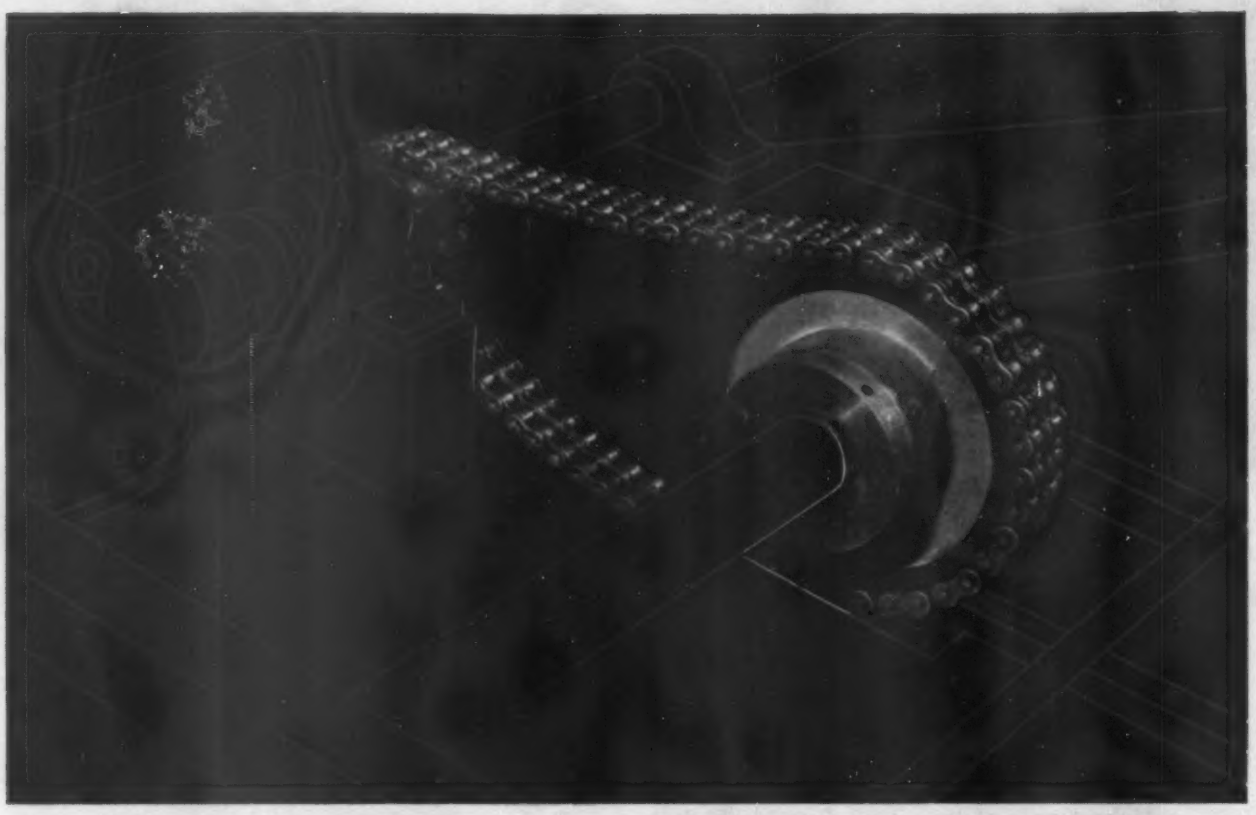
In view of these facts we suggest that you carefully review your screw machine operations. If you normally operate at speeds lower than 350 SFM, your best bet is USS MX, either Bessemer or Open Hearth. You'll be money ahead – get more parts per hour, longer tool life and better parts—if you use MX, which you can buy at the *same* price you pay for comparable grades.

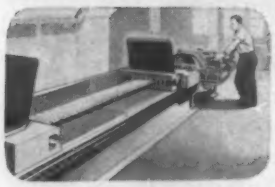
USS Free-Machining MX is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier either as "MX" or under his own identifying trade name. In hot-rolled form MX is available through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

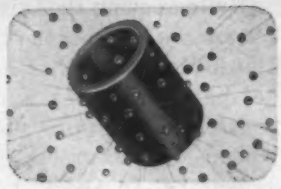
USS

UNITED STATES STEEL





PRE-STRESSING of multiple width chain provides uniform load distribution.



SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.

CLOSER HEAT-TREAT CONTROL — coupled with rigid testing insures uniformity.

LOCK-TYPE BUSHINGS (applied on a range of sizes) end a cause of stiff chain.

How EXTRAS* like these cut your roller chain costs

*And you pay no premium for these LINK-BELT extras

LINK-BELT Precision Steel Roller Chain meets the three big requirements for lower drive and conveyor costs.

(1) Long life— Added manufacturing refinements like the four shown above are your assurance that Link-Belt roller chain lasts longer.

(2) Low maintenance costs— High resistance to wear eliminates frequent adjustments.

(3) High efficiency — Positive action, independent of atmospheric conditions. No power loss through slippage or excessive bearing friction.

You can get complete information from 148-page Data Book 2457. It covers single and multiple width roller chain and sprockets in ¼" through 3" pitch, 1" through 3" double pitch. Ask your nearest Link-Belt office or authorized stock carrying distributor for a copy today.

LINK-BELT

13,067

ROLLER CHAIN & SPROCKETS

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

on an *Acme-Gridley*

FULLY AUTOMATIC BAR TYPE TURRET LATHE

you can machine this finger-holder spool in 3 minutes

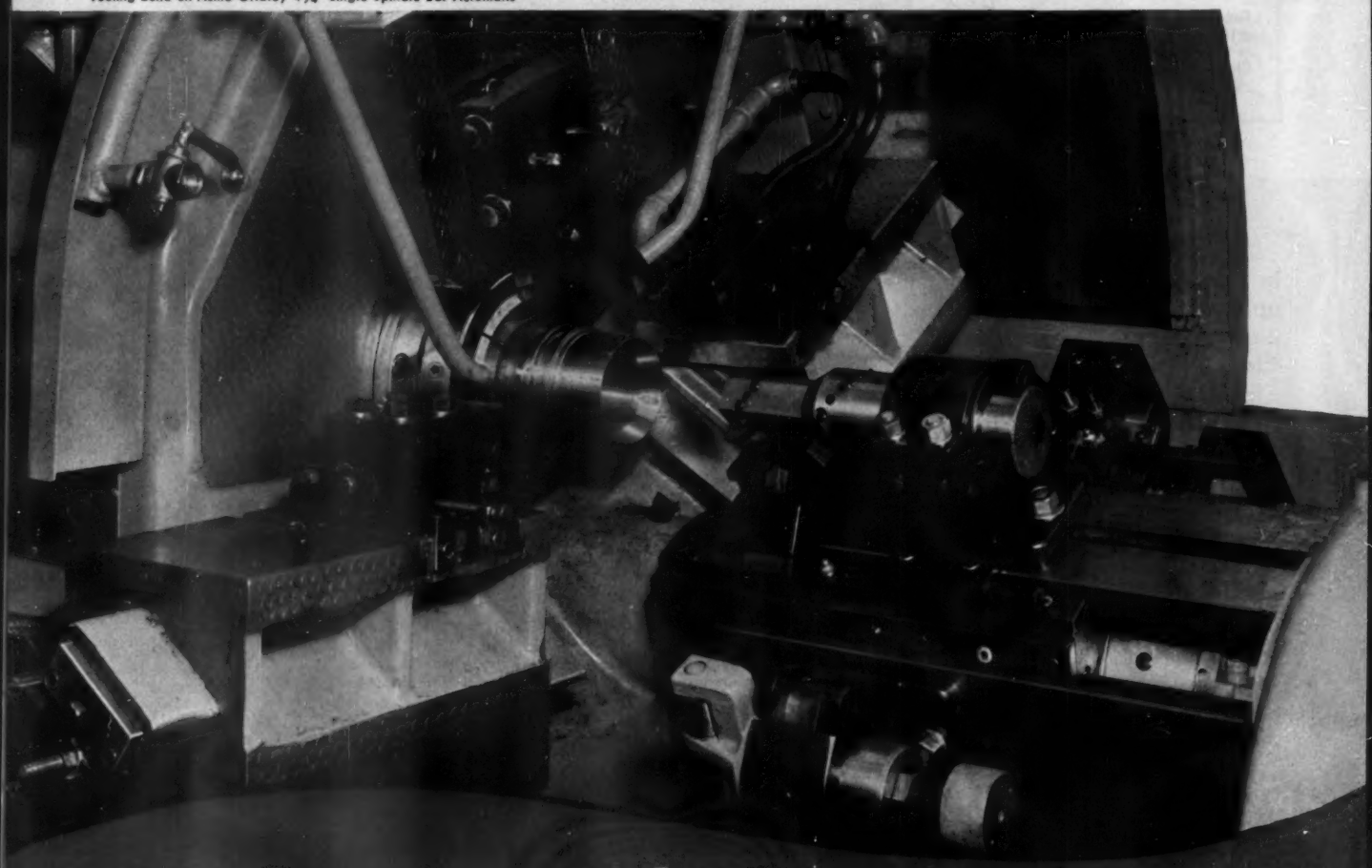
. . . and do it all day long!

Material—4620 Steel Tubing
Machine Time—3 Minutes
Number of Operations—15, including angular turning attachment; carbide tooling throughout.

Here's the answer: Dependable, automatic control of the work cycle . . . production is always at the same predetermined rate. Also, on the ACME-GRIDLEY Single, you complete more operations on the primary tooling setup—the best way to get greater accuracy, save time and save floor space. *And* one man can operate two or more machines, depending upon the cycle time of the work involved.

Why not learn more about the machine that made such a big hit at the Machine Tool Show? Get the full details in Catalog M-50A . . . then you'll *want* to discuss your production with a National Acme engineer.

Tooling zone on Acme-Gridley 4¼" Single Spindle Bar Automatic



the National Acme company

171 EAST 131ST STREET • CLEVELAND 8, OHIO

VK PLAIN PLUG GAGES ▾▾ class XXX !!

Chromium Plated Steel Gages, Wire Type .010" to 1.010" dia.

Chromium Plated Steel Gages, Taper Lock .010" to 1.510" dia.

Tungsten Carbide Gages, Wire Type .010" to .365" dia.

Chrome Carbide Gages, Taper Lock .365" to 1.510" dia.

Now available for fine inspection requirements

In response to persistent demand, VK has developed and now announces a new, ultra-fine, plain plug gage tolerance of .00001", designated as Class XXX. This new tolerance, half of that of Class XX, satisfies a need, long evident, for gages to meet part limits finer than .0002", and permitting only ten millionths of an inch total variation on the gage in sizes up to .825" diameter, and only fifteen millionths in sizes from .825" to 1.510" diameter. Tolerance may be applied either bilaterally or unilaterally.

Inasmuch as Class XXX tolerance must take into account such factors as finer diameter variation, a high order of roundness control, an exceptional surface finish and an extreme resistance to wear (all of which offset the shallow wear depth inherent in such a gage class), Class XXX is offered in only Chromium Plated and Carbide Gages.

VK Class XXX Plain Plug Gages are furnished in the materials, styles and ranges shown in boxed panel above. VK also furnishes Class XX, X, Y, and Z standard tolerance plug gages in wire type, taper lock and trilock designs. For complete information address: The Van Keuren Company, 173 Waltham St., Watertown, Mass.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

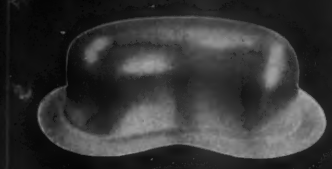
VK

36th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.



One operation
0.064" 24SO Aluminum

One operation
0.051" 24SO Aluminum

One operation
0.064" 61SO Aluminum

Drop Hammer combined with one Hydroform operation.
0.064" 61SO Aluminum

One operation
0.040" 75SO Aluminum

One operation
0.025" RC70 Titanium

One operation
0.051" 61SO Aluminum

◀CINCINNATI HYDROFORM MACHINES AT NORTH AMERICAN AVIATION, Inc. 26" machine in foreground, 12" machine in background. For a description of the Hydroforming process and specifications of the 8", 12", 19", 23", 26", and 32" machine sizes, write for Bulletin

Two operations
0.040" 61SO Aluminum

Two operations
0.032" 52SO Aluminum

Three operations
0.032" 61SO Aluminum

These are typical aircraft components produced on two *Cincinnati Hydroform* machines at North American Aviation, Inc. Hydroforming has increased their overall production of intricately-shaped parts . . . made from all types of materials ranging from aluminum to titanium . . . at *very substantial savings* in development and production time, in tooling, material and labor costs.

To determine if Hydroforming can produce similar savings for your manufacturing program, call a Cincinnati Milling field engineer.

One operation
0.051" 61SO Aluminum

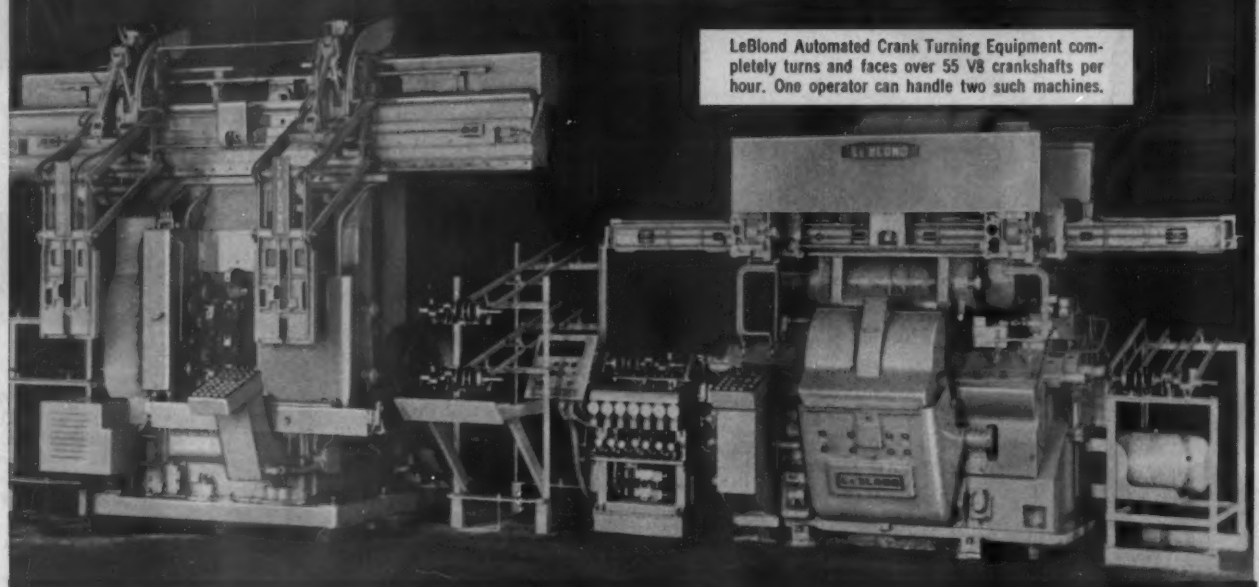
CINCINNATI

Hydroform

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

One operation
0.064" 61SO Aluminum

ANOTHER EXAMPLE OF VICKERS® Hydraulics in AUTOMATION



LeBlond Automated Crank Turning Equipment completely turns and faces over 55 V8 crankshafts per hour. One operator can handle two such machines.

This new LeBlond Automated Crank Turning Equipment machines crankshafts at an exceptionally high rate. All operations of the Models LBA and PBA machines shown above are hydraulic with the exception of the actual rotation of the crank . . . here a Vickers hydraulic motor is used for braking and jogging the electric motor drive. All hydraulic power is supplied by Vickers Pumps and controlled by Vickers Valves.

In addition to the advantages inherent in hydraulic control, Vickers Hydraulics gives you the benefits of a nation-wide and full-time field engineering and service organization to assure correct application and operation with least maintenance. Vickers has the complete line of hydraulic equipment necessary to take undivided system responsibility . . . to eliminate any risk of incompatibility of hydraulic components.

The Vickers Application Engineer near you will be glad to demonstrate the many benefits you can obtain by using Vickers Hydraulics. Write for a copy of Catalog 5001A.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
1410 OAKMAN BLVD. • DETROIT 32, MICHIGAN

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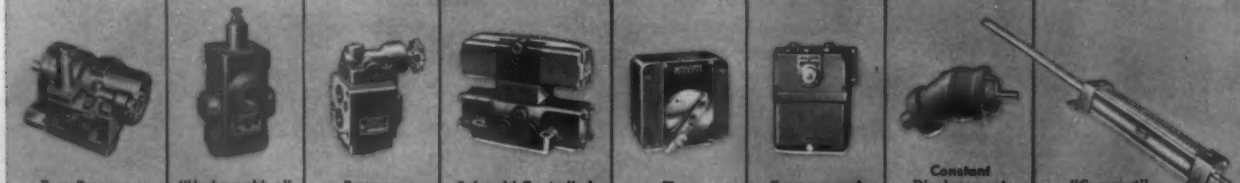
7301

Representative Standard VICKERS Units Used on LeBlond Automated Crankshaft Lathe

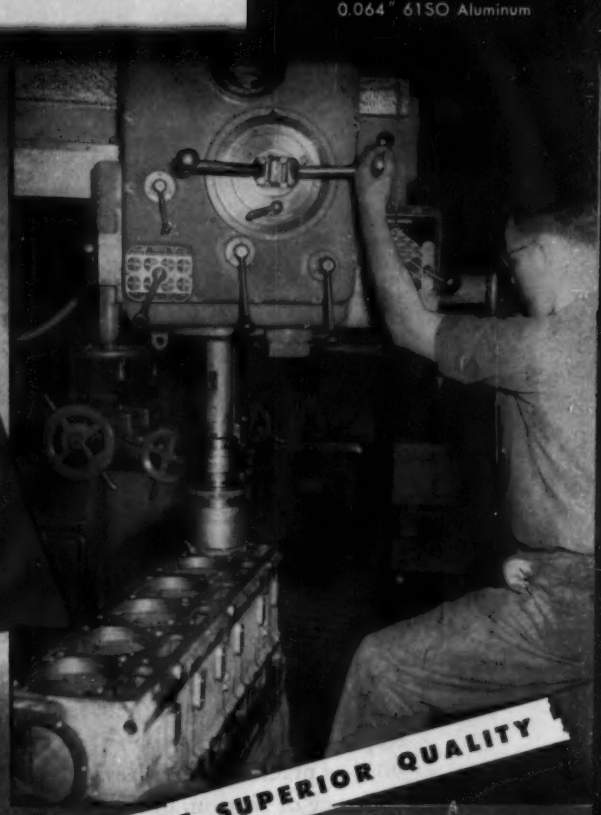


Two-Pressure Balanced Vane Pump | "Hydrocushion" Type Sequence Valve | Pressure Reducing Valve | Solenoid Controlled Pilot Operated 4-Way Valve | Flow Control Valve | Traverse and Feed Cycle Control Panel | Constant Displacement Piston Type Hydraulic Motor | "Compact" Hydraulic Cylinder

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

0.064" 61SO Aluminum

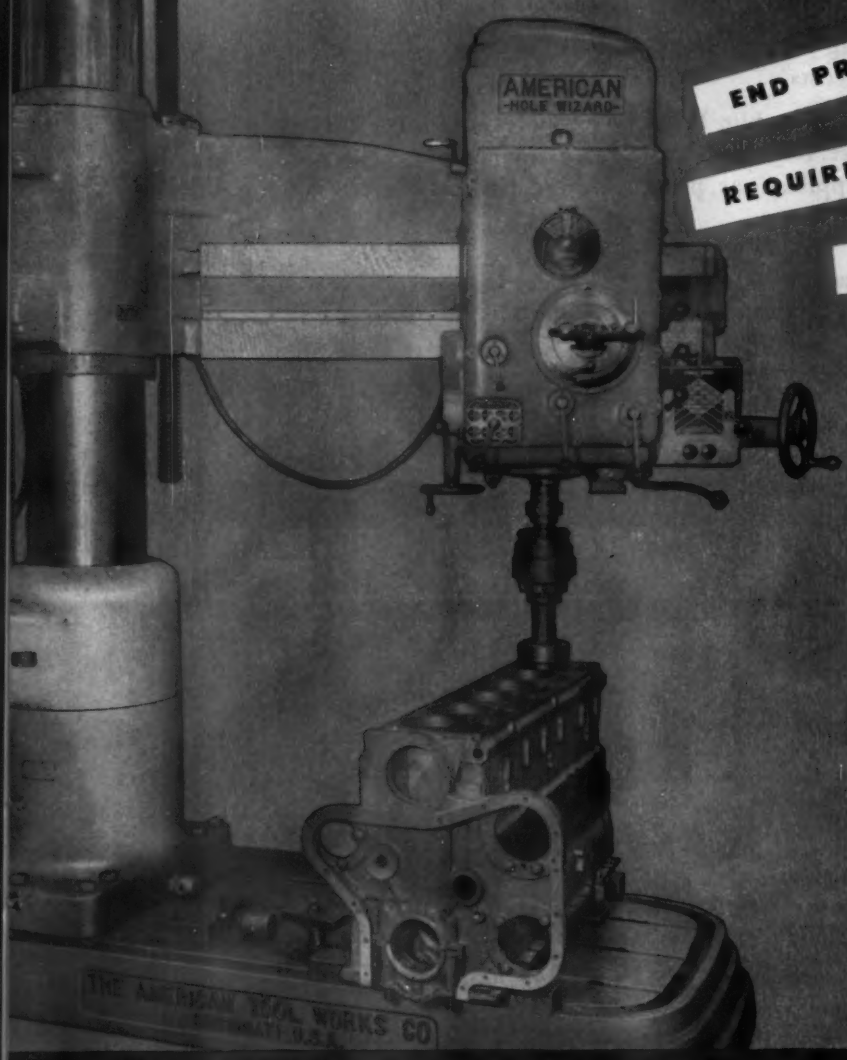
The 2 are inseparable—



END PRODUCTS OF SUPERIOR QUALITY

REQUIRE SUPER QUALITY EQUIPMENT

TO PRODUCE THEM . . .



For six years this "AMERICAN" Hole Wizard Radial has been counterboring "Cummins" Diesel Engine Blocks and holding the required depth tolerance of .001' in the 6.125" counterbores. Furthermore, the operator testifies to the fact that the machine is convenient and easy to operate and maintenance has been negligible.

The quality of "Cummins" products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

You can machine Stainless Steel parts like these at rates up to 90% of Bessemer screw stock

You can do it with free-machining ENDURO Stainless Steel Bars. They'll machine beautifully at every station on your automatics. And you'll be giving your duplicate steel parts the added strength, appearance, and heat- and corrosion-resistant qualities of stainless steel.

Included in the complete range of stainless steel analyses supplied in cold finished form by Republic's Union Drawn Steel Division are two grades, A.I.S.I. 416 and 430-F, that are fully 90% as machinable as Bessemer screw stock. Add to this machinability the close tolerance, accuracy of section, uniform soundness and fine surface finish provided by cold drawing.

All these qualities combine to help you produce fine-quality stainless steel parts at highest production rates and at lowest unit costs.

In addition to cold finished bars, Republic ENDURO Stainless Steel is available in hot rolled bars, special sections and wire. Republic metallurgists and engineers will give you expert, obligation-free assistance on applications, processing and use. Just mail the coupon for more information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
3102 East 45th Street
Cleveland 27, Ohio

Please send me more information on:

☐ Free-Machining ENDURO® ☐ Titanium

☐ ELECTRUNITE® Mechanical Tubing ☐ "Nylok" Nuts

Name_____ Title_____

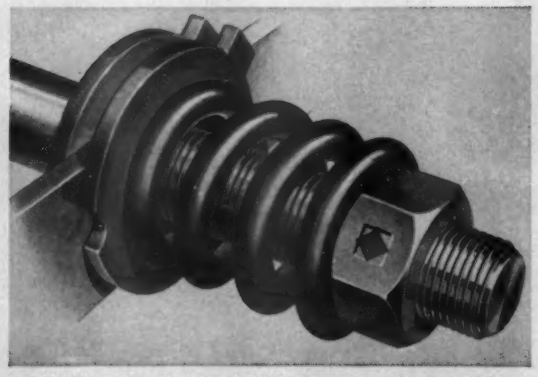
Company_____

Address_____

City_____ Zone____ State_____

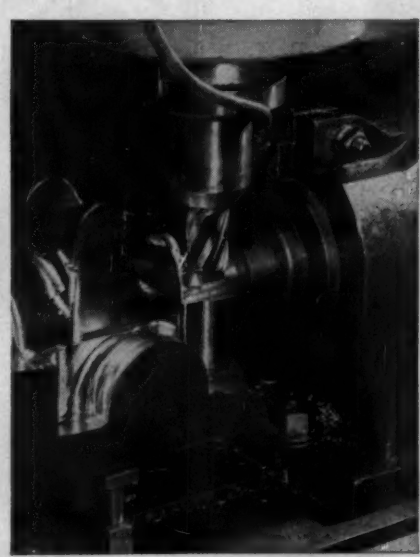
K-8013

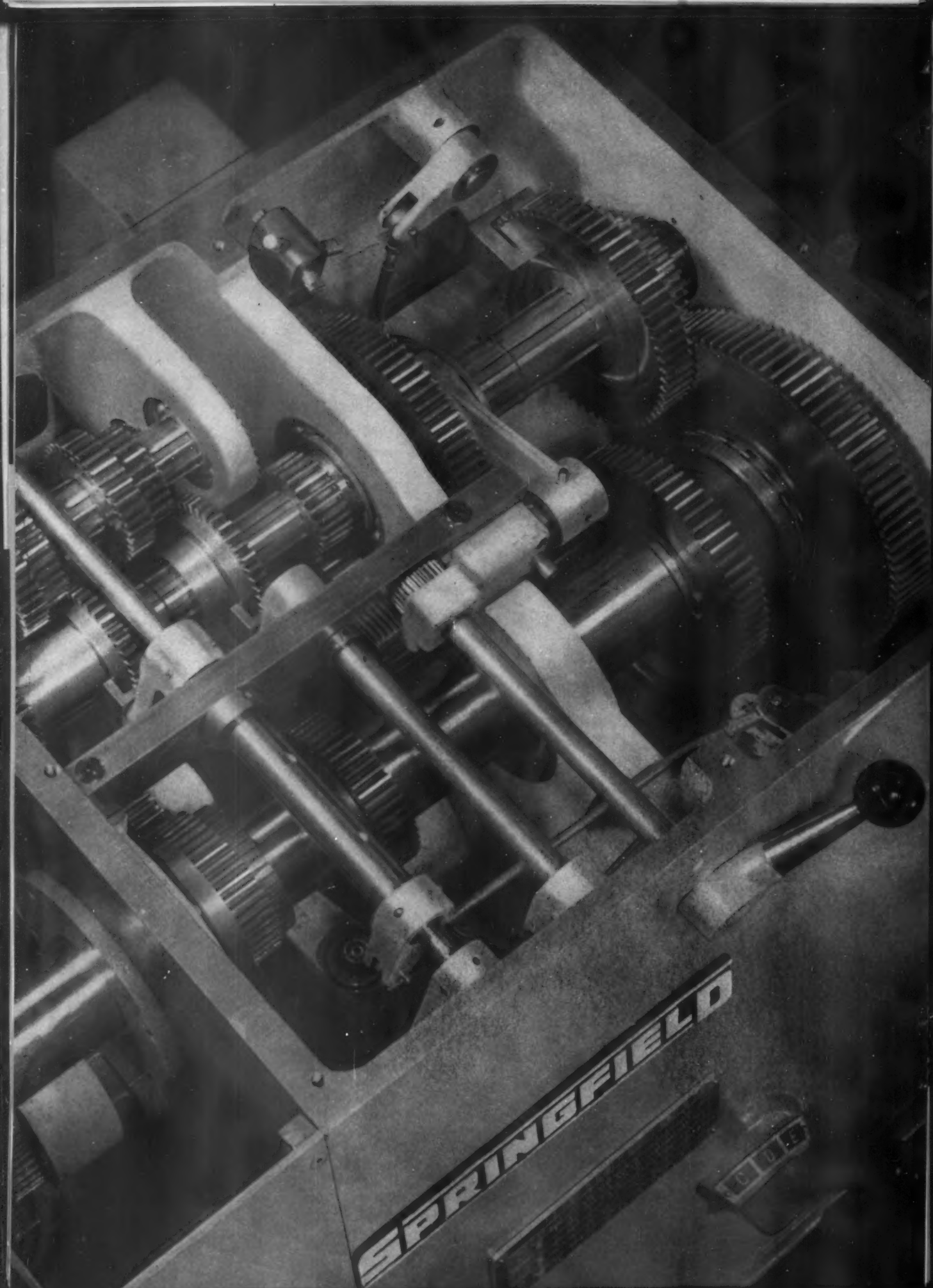
YOU CAN MASTER PROBLEMS LIKE THIS with ELECTRUNITE Mechanical Tubing. Interior scratches, not detected before assembly, wore out the hydraulic fluid seals in a hurry in the hydraulic cylinder of the Farmhand Hi-Lift Loader. Farmhand discussed the problem with Republic's Steel and Tubes Division. The solution—a switch to special smooth ELECTRUNITE Tubing. The result—lower production costs; fewer rejects; consistently uniform inside surface finish; longer life for the seal. ELECTRUNITE Mechanical Tubing is available in carbon and stainless analyses.

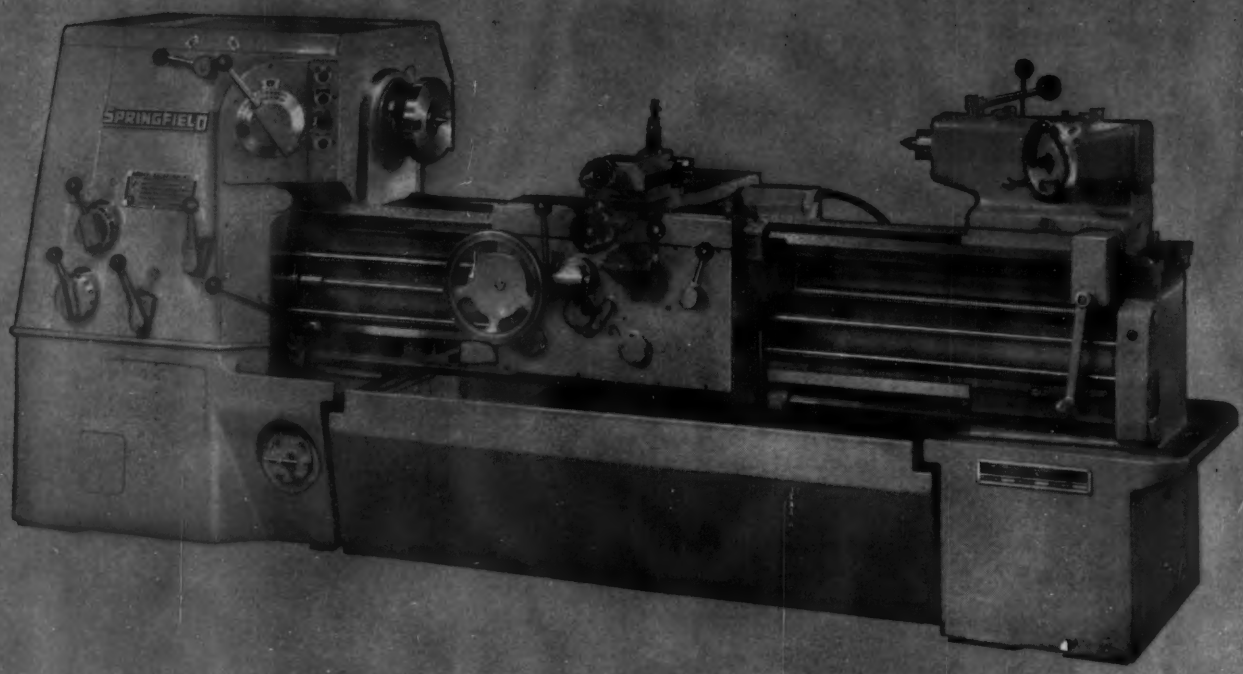


YOU CAN BE SURE THAT THIS NUT WILL STAY TIGHT wherever you stop wrenching. It's Republic's "Nylok" Nut. A nylon plug in the side forces the nut tight against the opposite threads as the nut is turned on. It can be assembled from either end, manually or mechanically fed. Can be locked in any position. Photo shows positive adjustment of spring compression.

YOU CAN MACHINE TITANIUM PARTS like parts made from many other metals. This part is being hogged out of a titanium forging. It will then be turned, drilled, reamed, ground, tapped and threaded. Republic metallurgists recommend metals without prejudice. They will tell you whether titanium can be adapted to your product—will help you use it to advantage. Republic produces titanium and titanium alloys in hot and cold rolled bars, sheets, plates and billets.




SPRINGFIELD



more useful horsepower

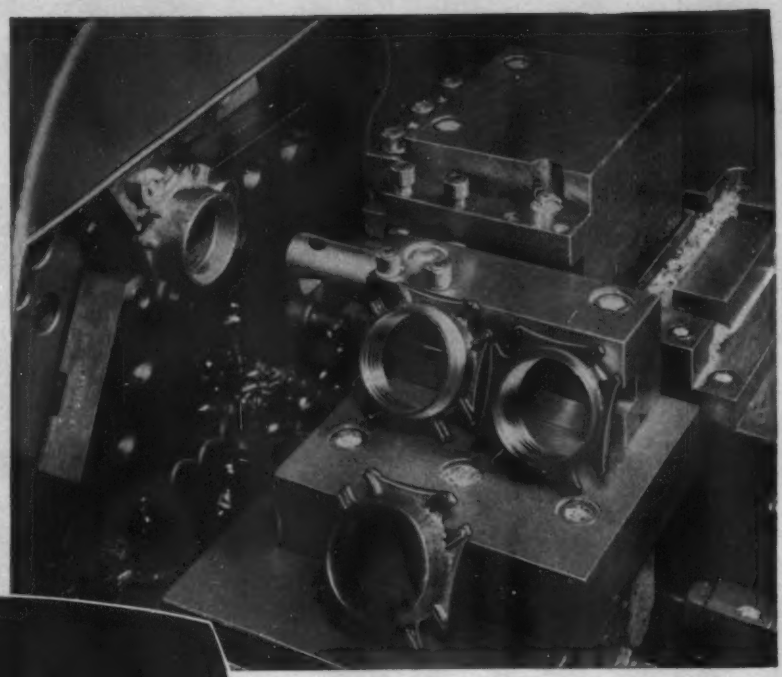
All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

The Springfield Machine Tool Company
Springfield, Ohio

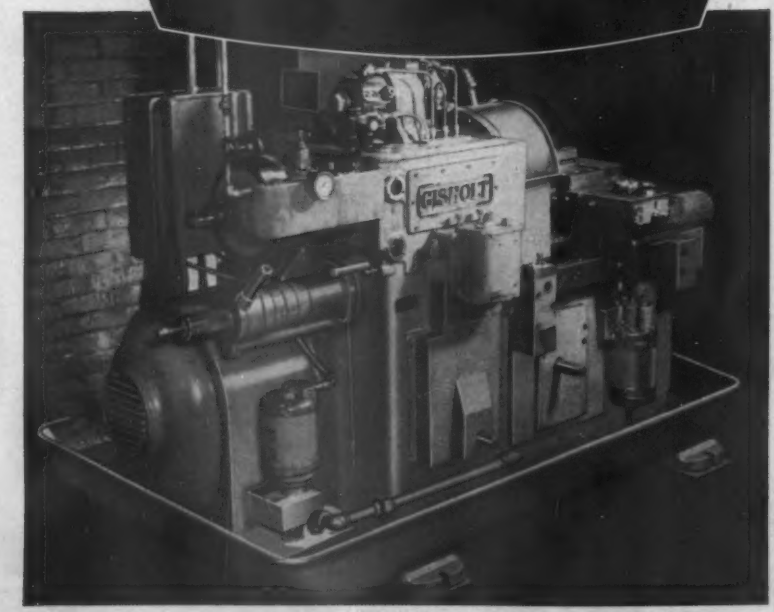
68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

Small Job Shop Catches the BIG IDEA



cuts costs with—

GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE



No matter whether the shop is large or small . . . if there's volume, there's the opportunity to make money faster with automatic machining.

The Kilbourn Engineering Company of Milwaukee saw it—and proved it again—subcontracting these parts for electric hot water heaters with the Gisholt No. 12 Hydraulic.

Greater Production

With its fast automatic cycle and multiple cutting, the Gisholt turns out these parts at twice the rate of the previous method. A man merely loads and unloads the machine. The owner is not limited to this one job either. It is easily set up to handle a variety of work up to 12" in diameter.

Corner for Profit

Such work can be highly profitable for job shops. Especially when the whole operation can be tucked into one small corner of the shop as this one is.

Progressive thinking like this is what makes many small shops grow into big ones. Gisholt engineers can help you with all kinds of ideas for making the most of machine tools.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Call U. S. STEEL SUPPLY for ALL your steel needs...

Structural Shapes
Plates
Bars—Hot and Cold Finished
Sheets and Strip
Alloy Steels
Stainless Steels
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High Strength Steels
Aluminum
Industrial Supplies and Machinery
Floor Plates, Industrial Flooring
Reinforcing Bars, Wire Fabric

YOU GET THE *right* COLD FINISHED STEEL FOR YOUR JOB!

Because U.S. Steel Supply carries all types, sizes, shapes and finishes, we can help you select the RIGHT Cold Finished Bars for your requirements—and the right quality is not always the most expensive.

Carbon, Alloy and Stainless Rounds, hexagons, squares and flats are all smooth finish, close to size, true to shape and straight. To serve all your requirements we also carry Turned and Polished—and Turned, Ground and Polished shafting.

Our USS MX Free Machining bars have earned great popularity as one of the best high speed screw stocks because it cuts unit costs considerably . . . an average of 10% to 15%, sometimes as high as 42%. MX costs no more than B-1113 and it will increase your net production 20% or more.

LEADED Screw Stock, very fast machining, is especially economical on long production runs of small parts that require extensive machining.

Our technical staff is ready to assist you with application problems. They will make certain that you get the best and most economical bar for *your* job.

USS STEEL — UNITED STATES STEEL

FREE...
OUR LATEST STOCK LIST

Contains everything you'll want to know about our huge stocks . . . tells what's actually in stock at our warehouse nearest you. All data is specific, complete, accurate, up-to-date—and easy to find. Send the coupon today for this big, all-new Stock List.

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Please send me—without charge or obligation—your latest Stock List.

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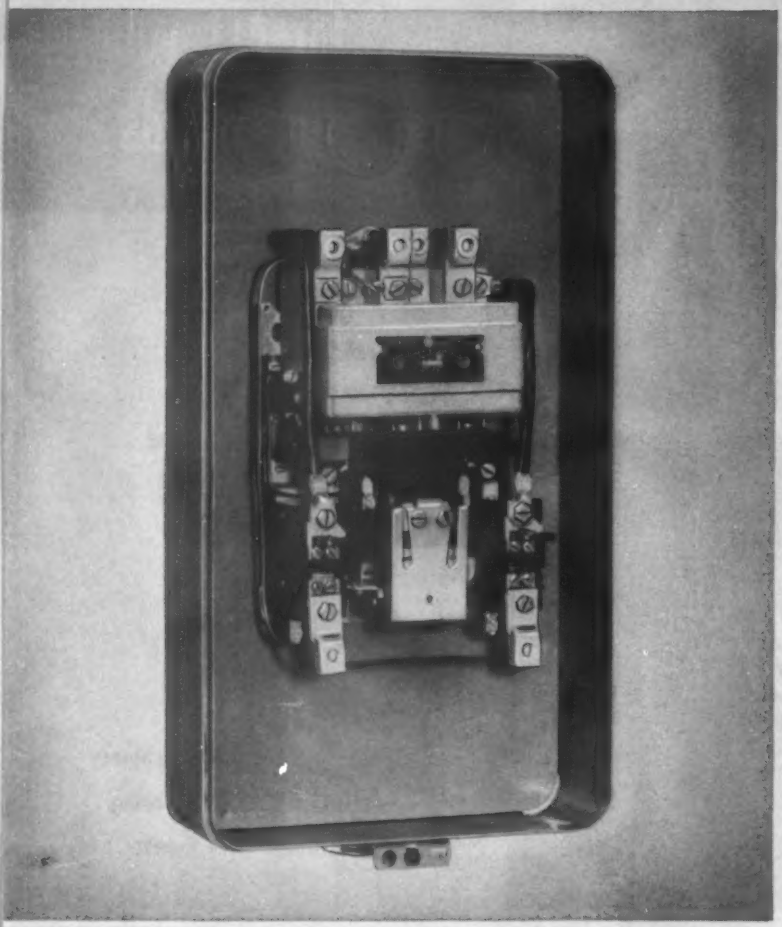
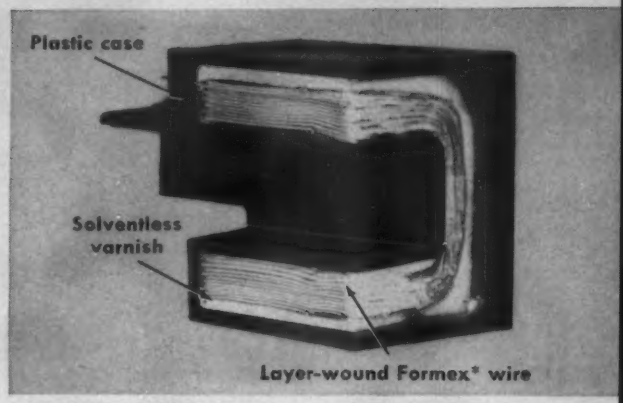
UNITED STATES STEEL

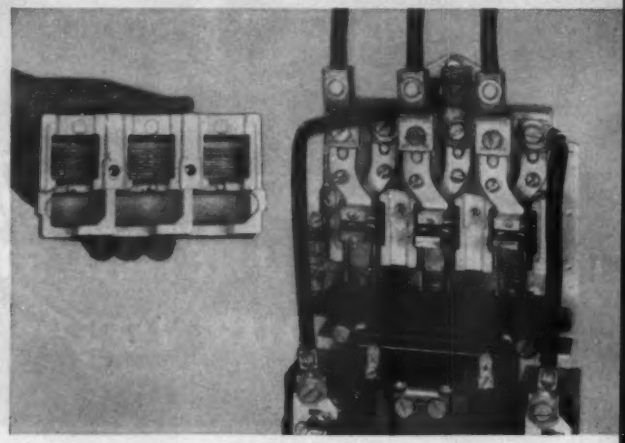
NEW G-E SIZE 4 STARTER



NEW SIZE 4 STARTER is designed for full-voltage starting of squirrel-cage motors. Bi-metallic overload relays may be easily changed from manual to automatic reset without removing from case.

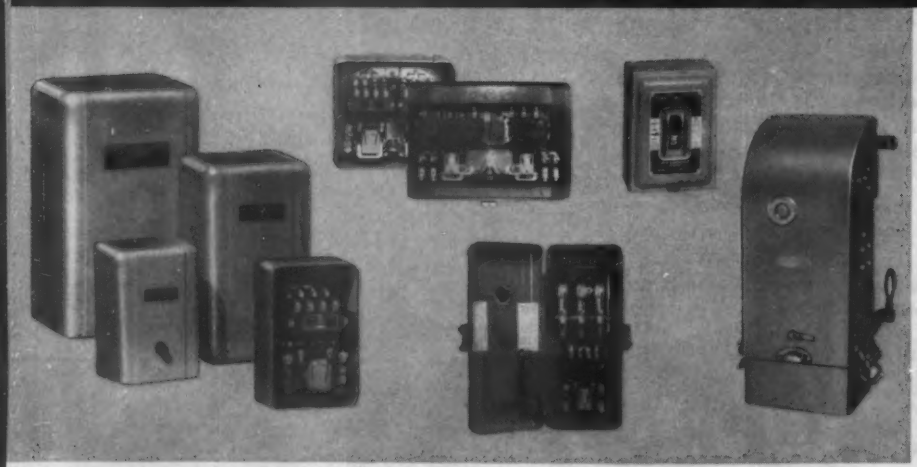


STRONGBOX MAGNET COIL is enclosed in a tough molded plastic case. Coil has firmly anchored terminals and is protected against dirt, oil and moisture.



SPECIAL ALLOY CONTACTS give long weld-free life. Arcs are quickly extinguished by new blow-out design of contacts and cooling action of grids.

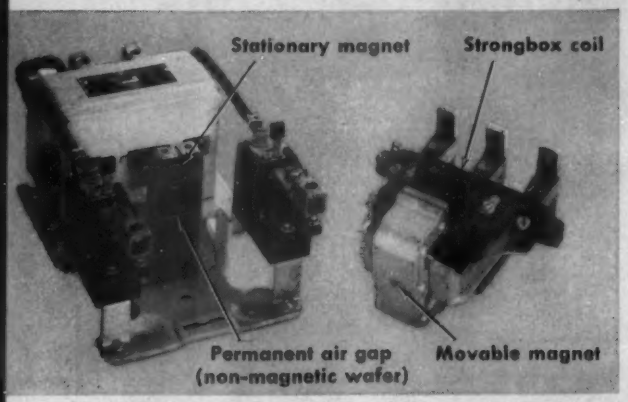
CHOOSE FROM THE COMPLETE LINE



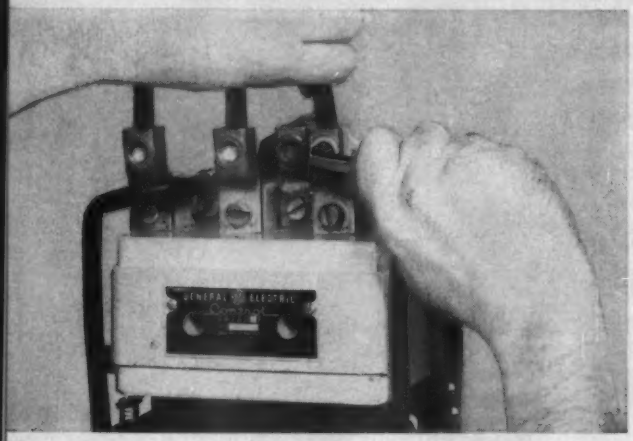
THOUSANDS OF STARTERS are available. They include: combination, reversing, multispeed, and manual and magnetic starters for full- or reduced-voltage starting. Starters are available in all popular NEMA and special enclosures.

PUSH BUTTONS are furnished for standard, heavy-duty, or oiltight applications. Stations come in all NEMA enclosures.

FOR 25- TO 100-HP MOTORS



PERMANENT AIR GAP, away from striking surfaces, can't wear down and cause starter to "stick-in." Magnet design prevents contact chatter.



FRONT WIRED AND MOUNTED, new starter has solderless, pressure-type terminals for wires from AWG No. 6 to 250,000 c.m. 3-point front mounting is easy.

New magnetic starter for squirrel-cage motors

General Electric now adds a new, compact, NEMA Size 4 starter to its complete line of magnetic starters. The new starter offers many customer-proved features of size 0 to 3 G-E magnetic starters, such as the strongbox coil and the permanent air gap.

INSTALLED FROM THE FRONT, the new starter has 3-point mounting, and is completely accessible from the front when mounted. Right up in front are the solderless, pressure-type terminals for easy wiring. Also, 3 electrical interlocks, in any combination, can be installed from the front without removing the arc chute or movable-contact assembly. A vertical or horizontal mechanical interlock is also available for reversing and multispeed controllers.

MAINTENANCE IS EASY, and a screwdriver is the only tool required. Contacts are readily changed, and both coil and contacts are removable from the front without disturbing power wiring.

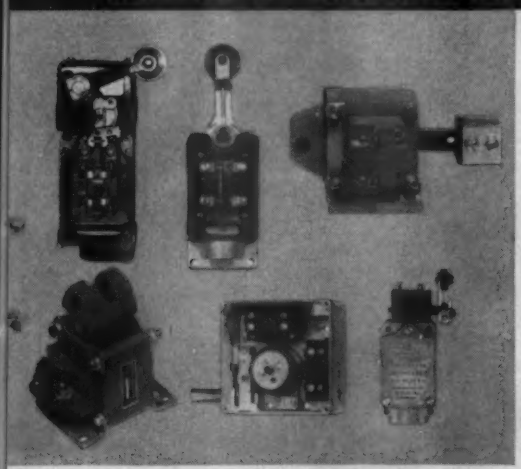
FOR MORE INFORMATION, contact your nearest G-E Apparatus Sales Office or Distributor, or mail in the coupon below. Ask for Bulletin GEA-6322.

**Reg. Trade-mark General Electric Co.*

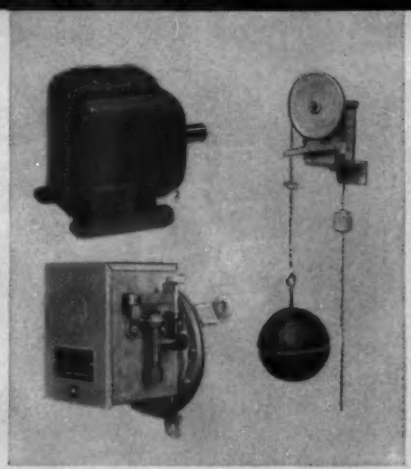
Progress Is Our Most Important Product

GENERAL ELECTRIC

OF G-E CONTROL DEVICES



LIMIT SWITCHES AND SOLENOIDS include lever and cam type limit switches, and the new strongbox solenoid.



G.E.'s LINE OF SWITCHES include pressure, vacuum, float, plugging and anti-plugging, pilot and reversing switches.

FREE NEW CATALOG of G-E General Purpose Controls.

Advertising and Sales Promotion Sect. K 734-2
General Purpose Control Department
General Electric Company
Bloomington, Illinois

Please send a free copy of:

☐ **GEC-1260A** New Control Catalog
☐ **GEA-6322** New Size 4 Starter
☐ **For reference** ☐ **For immediate project**

Name.....
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Every Feature Worth a Close, Close Look!

You're Right There! No stretch, no reach, no awkward lifting. Lathe has clean, close front with spindle right under hands.

Why Fight Chips? Bedway design provides chutes to empty chips into open pan at rear of lathe. Simple, practical, time-saving.

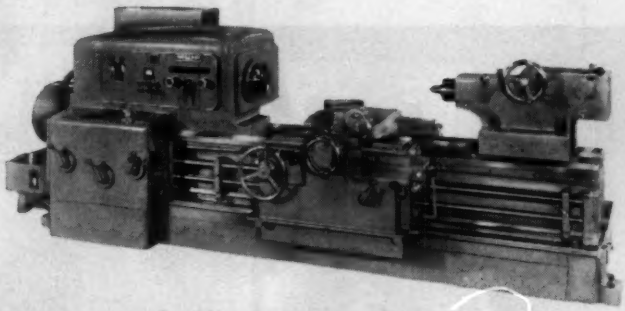
Headstock With a Brain! Dial work diameter setting and surface cutting speed setting. Dyna-Shift headstock *automatically calculates* required spindle speed and shifts to it hydraulically. No mental gymnastics — no compromise speeds!

Two for One. When turning medium steel, 1 cubic inch of metal removal per motor horsepower has been considered good performance. On the Series 80 you can raise that to over 2 cubic inches per motor horsepower.

Support Without a Thought. On longer bed lathes, the leadscrew, feed and control rods are continually supported by traveling carriers that are automatically picked up and dropped off by apron movement.

Infinitely Variable — Infinitely Effective. *Variable speed* four-way hydraulic rapid traverse of carriage and cross slide brings tool to work at the rate of travel you choose—does away with final manual positioning.

The Monarch Series 80 DYNA-SHIFT... The New Look in Heavy-Duty Lathes



MONARCH SERIES 80 DYNA-SHIFT LATHE, 36 Spindle Speeds. Headstock Ratio—125 to 1.

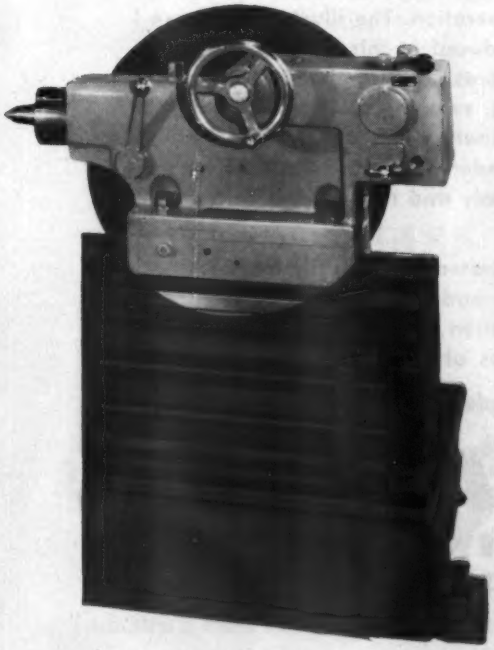
Models 1600 and 1601. Clearance diameter 26″ and 30″. Swing over cross slide 16″ and 20″. Speed Range 10-1250 RPM.

Models 2000 and 2001. Clearance diameter 32″ and 36″. Swing over cross slide 20″ and 24″. Speed range 8-1000 RPM.

Here's the lathe that's the talk of the shop and front office alike! The new Monarch Series 80 Dyna-Shift provides a completely new approach to the problem of heavy-duty metal turning —and the results are a rate of metal removal beyond the reach of previous designs; plus added production caused by the many exclusive, new built-in conveniences.

A look at just the few features pictured here tells why. Every one adds to the increased productivity and ease of operation of the machine. And there are so many more that we've prepared a complete, illustrated booklet to tell you about them. For full information on the lathe that gives you ultimate proficiency in the use of carbide tooling on work of considerable size—send for our Booklet #1602 . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

Nimble Tailstock.
Two speed range spindle movement — *power positioning* provided by engaging plunger on carriage and using longitudinal power rapid traverse.



Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

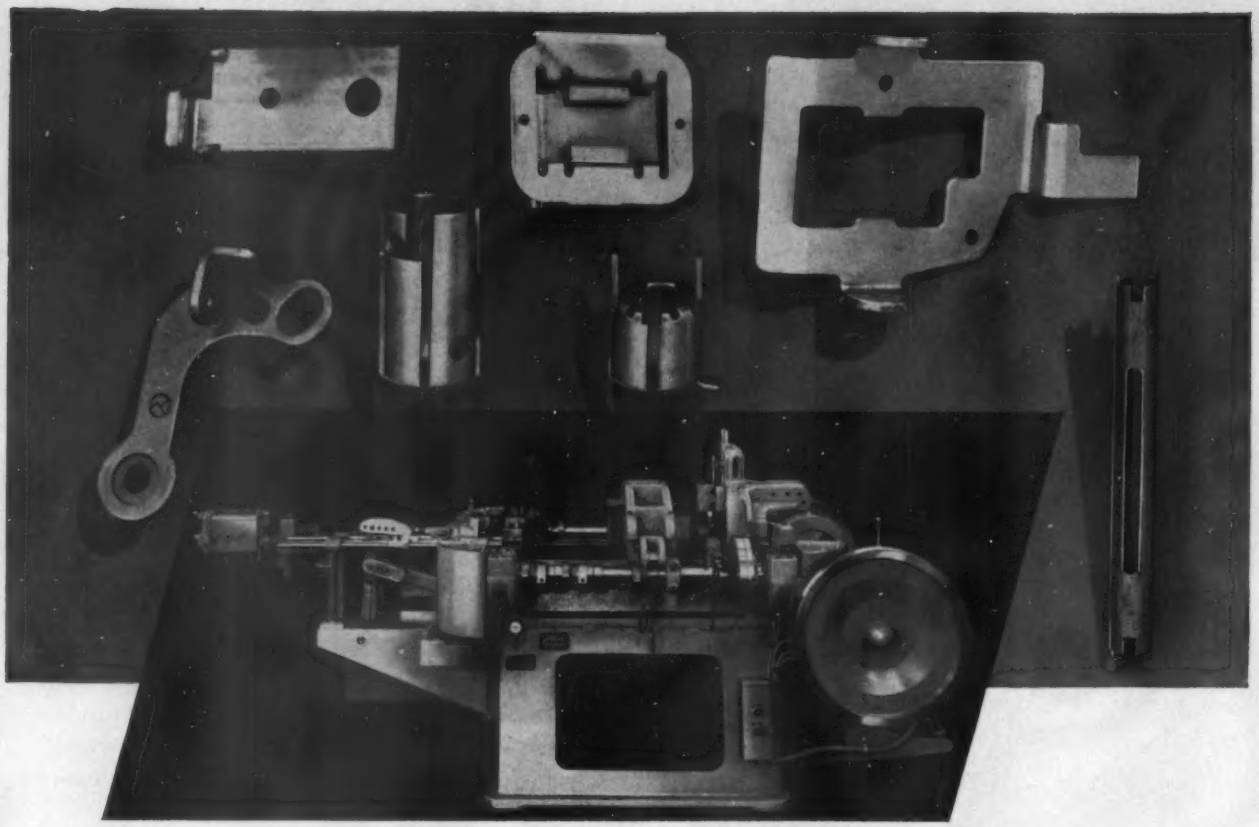
Clip this coupon to Your Letterhead for Complete Dyna-Shift Booklet

MONARCH MACHINE TOOL COMPANY
Sidney, Ohio

Please send me your illustrated booklet #1602 describing the Series 80 Dyna-Shift Lathe.

NAME_____

TITLE_____



FOR *AUTOMATIC* PRODUCTION OF *PRECISION* STAMPINGS THE U. S. MULTI-SLIDE®

In the production of precision stampings, every secondary operation, every inspection, every handling helps to send your costs UP! You can keep these costs at a minimum by using U. S. Multi-Slide Machines to produce parts rapidly, accurately, and *complete* in a single operation. The illustration above shows some typical parts which have been produced in this manner in U. S. Multi-Slides. These parts—of copper, aluminum, brass and steel—illustrate the variety of operations, including piercing, trimming, swaging, coining, blanking and forming, which can be performed in any combination in a U. S. Multi-Slide. Many of these parts formerly required costly secondary operations and intermediate inspections. Now they are produced uniformly and to close tolerances in a single, high-speed operation.

U. S. Multi-Slide Machines are built in four sizes. Illustrated above is the No. 33 Machine, with capacity for material up to 2½" wide and feed length adjustable up to 12½". If your program involves the production of precision stampings, investigate the labor-saving, time-saving features of U. S. Multi-Slides.

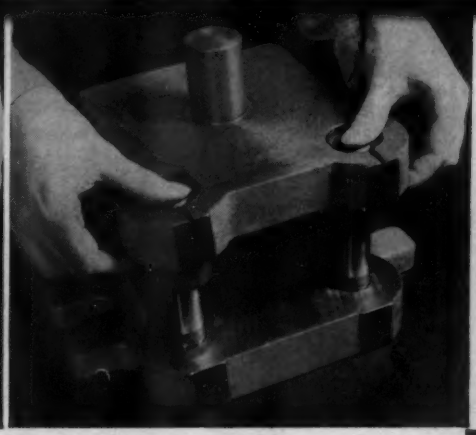
Ask for a copy of Bulletin 15-A containing complete specifications.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories



Here's a real test for quality...if you can make the punch holder glide up the pins just by squeezing—and hold its position without sinking back—it shows that the fit between pins and bushings is well-nigh perfect. The "finger-tip" action is typical of all DIECO die sets small enough to squeeze this way...and the larger ones are just as perfectly fitted.

What does "quality" in a die set mean to you?

If it means a perfect fit between pins and bushings...shoes that are absolutely parallel and stay parallel under load...*all* parts finished to precise tolerances with such unfailing regularity that there is never any variation in accuracy and serviceability among different die sets from the same source...then it stands to reason you must already be a user of DIECO die sets.

- Hardened steel pins superfinished and individually gaged to 0.0002" tolerance.
- High-tensile steel shoes, stress relieved and precision machined.
- Choice of bronze-plated bushings on hardened steel backing or hardened steel bushings—all with grease fittings. Precision ground and micro-honed to less than a "tenth" tolerance; can be arranged for pressure lubrication.
- Welded or screw shanks; any length guide pin.
- 1728 combinations in steel or semi-steel; interchangeable parts speed delivery.

E. W. BLISS COMPANY

BLISS SINCE 1857

DIE SUPPLY DIVISION

DIECO

1400 Brookpark Road, Cleveland, Ohio

Industry's most complete line of die sets and die makers supplies

DIE SETS • GUIDE PINS • BUSHINGS • SPRINGS
SOCKET HEAD SCREWS • 5001 ITEMS

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MODERN HEAT PROCESSING

HUMP MESH-BELT G-E furnace is used by Salkover for high-production bright brazing, annealing, and atmosphere quenching of stainless steel. Elevated heating chamber helps prevent air infiltration, assures pure atmosphere.

G-E BOX-TYPE BRAZING FURNACE, is one of three used by Salkover Metal Processing for low-volume, high-quality copper brazing and annealing.

CLEAN PARTS EMERGING from Salkover's G-E mesh-belt furnaces are placed directly in shipping boxes. No need for pickling, grinding or polishing because protective atmosphere keeps parts free of scale.

PROBLEM:

How to avoid the high cost of forging and machining

SOLUTION:

Brazing with G-E Furnaces Cuts Costs 25 to 50% for Salkover Customers

Many metal-product manufacturers are constantly faced with the same problem: how to avoid the high cost of forging and machining large volumes of metal parts. More and more of these companies in the Chicago area are finding the solution: fabrication . . . and brazing with Salkover Metal Processing of Illinois, Inc.'s new G-E furnaces.

SINCE SWITCHING to G-E furnace brazing, Salkover's customers have gained savings of between 25 to 50%.

Mr. Lee Mathis, Superintendent of Salkover, explains how their G-E furnaces made these savings possible: "With our seven G-E brazing and bright-annealing furnaces I can give my customers superior quality work. The furnaces in our new, modern heat-processing plant include box, mesh-belt, and roller-hearth types. And we're sold on them for three reasons: the heating units really last, over-all maintenance is very low, and the furnaces also have high productive capacity—all pretty important for the high-volume runs our customers bring in."

THE HEATING UNITS in the General Electric furnaces have so far given Salkover up to two years' life, with no intermediate maintenance. Maintenance of other component parts and down time of the furnaces have also been low.

Also, power input is high and thermal losses low. These features permit Salkover to hold down brazing and annealing costs to customers.

ASK FOR THE SERVICES of your local G-E Apparatus Sales Representative. He will show you how the installation of a G-E furnace can help you cut processing costs and increase the quality of your product.

GENERAL ELECTRIC

VERSATILE G-E ROLLER-HEARTH furnace with return conveyor pays for itself quickly at Salkover. Performs a variety of high-production jobs—brazing, bright annealing, sintering, bright normalizing.

FREE PROCESS BULLETINS

Please send me the Modern Heat Processing and technical bulletins I have checked below.

- ☐ Protective Atmospheres, GEA-5907
- ☐ Furnace and Induction Brazing, GEA-5889
- ☐ How and Where to Use Electric-Furnace Brazing, GEA-3193C
- ☐ Mesh-Belt-Conveyor Electric Furnaces, GEA-4071A
- ☐ Electric Box Furnaces With Cooling Chamber, GEA-4066
- ☐ Roller-Hearth Electric Furnaces, GEA-4072A
- ☐ Electric Furnace Brazing, GER-106
- ☐ Furnace Brazing of Machine Parts, GER-339

Section G721-5
General Electric Co.
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Smooth, even finishes are easier with Heller Spiral-Cut Half Round Files. Ordinary half round files require a skillful twisting. Heller engineering has removed this human element from good file performance. The necessary rolling action is designed right into the Heller Spiral-Cut Half Round File. This new cutting principal is typical of Heller's continuous search for better files. By constantly testing, inspecting, improving . . . Heller guarantees file users "the best."

HELLER TOOL CO. SINCE 1836

HELLER TOOL CO.

A Subsidiary of Simonds Saw and Steel Company

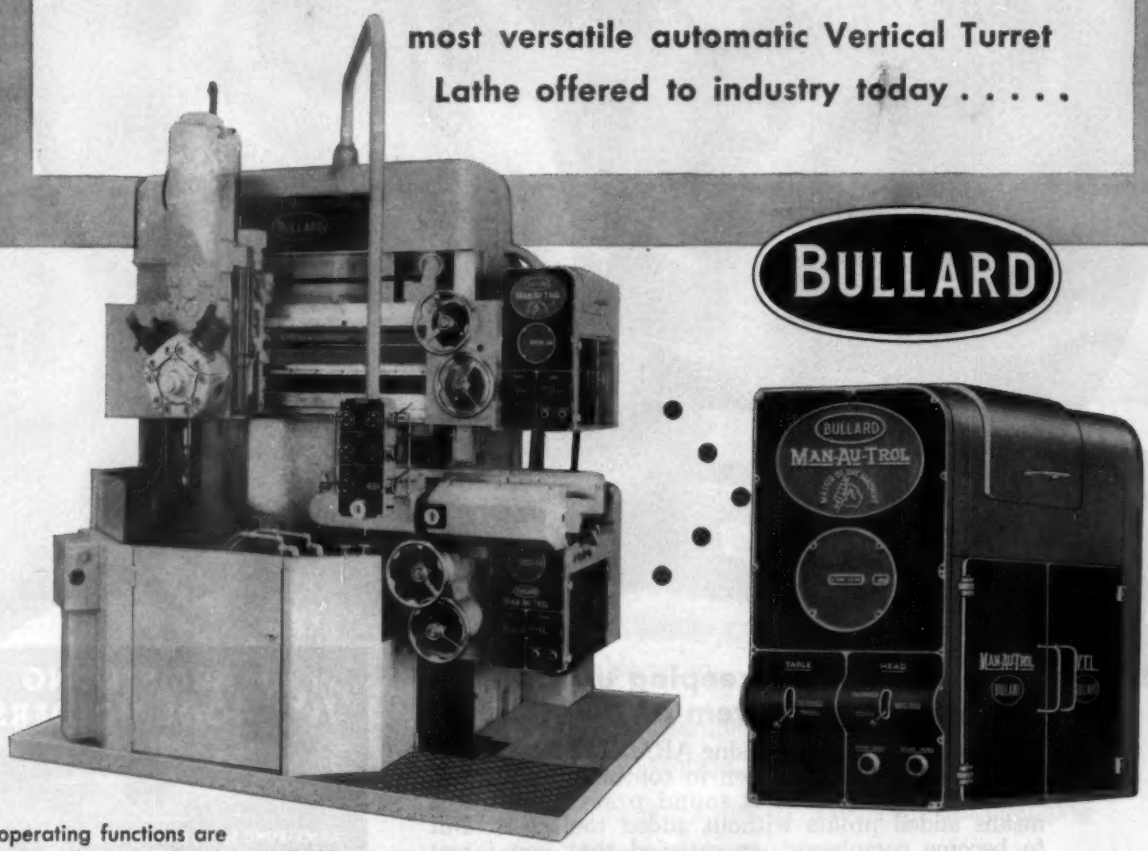
NEWCOMERSTOWN, OHIO . . . Branch Offices — New York, Chicago, Detroit, Los Angeles

YOUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

don't BUY BULLARD *unless* YOU WANT THE BEST!

Yes, Bullard Cut Master, Model 75 with Man-Au-Trol Conversion Unit is the best . . . most versatile automatic Vertical Turret Lathe offered to industry today . . . . .

BULLARD



All operating functions are automatically initiated and controlled by one function control drum and two detector drums in Man-Au-Trol: Table Speeds (20 Available), Feeds (16 Available), Head Travel in feed or traverse, right or left, up or down or 45° in any quadrant and Turret Indexing.

Since the function control drum can be pre-set for a given job in advance, the machine down time for job change-over is reduced to a minimum.

The Man-Au-Trol Conversion Unit can be applied to any or all heads of Cut Master, Model 75 right in your plant.

Your Bullard Sales Engineer will be glad to explain the many other advantages offered by Man-Au-Trol — your best buy in an automatic vertical turret lathe — call him or write for our new catalog.

THE BULLARD COMPANY
286 Canfield Avenue • Bridgeport 2, Connecticut

Please send me a copy of the
NEW MAN-AU-TROL, MODEL 75 CATALOG

NAME_____

COMPANY_____ POSITION_____

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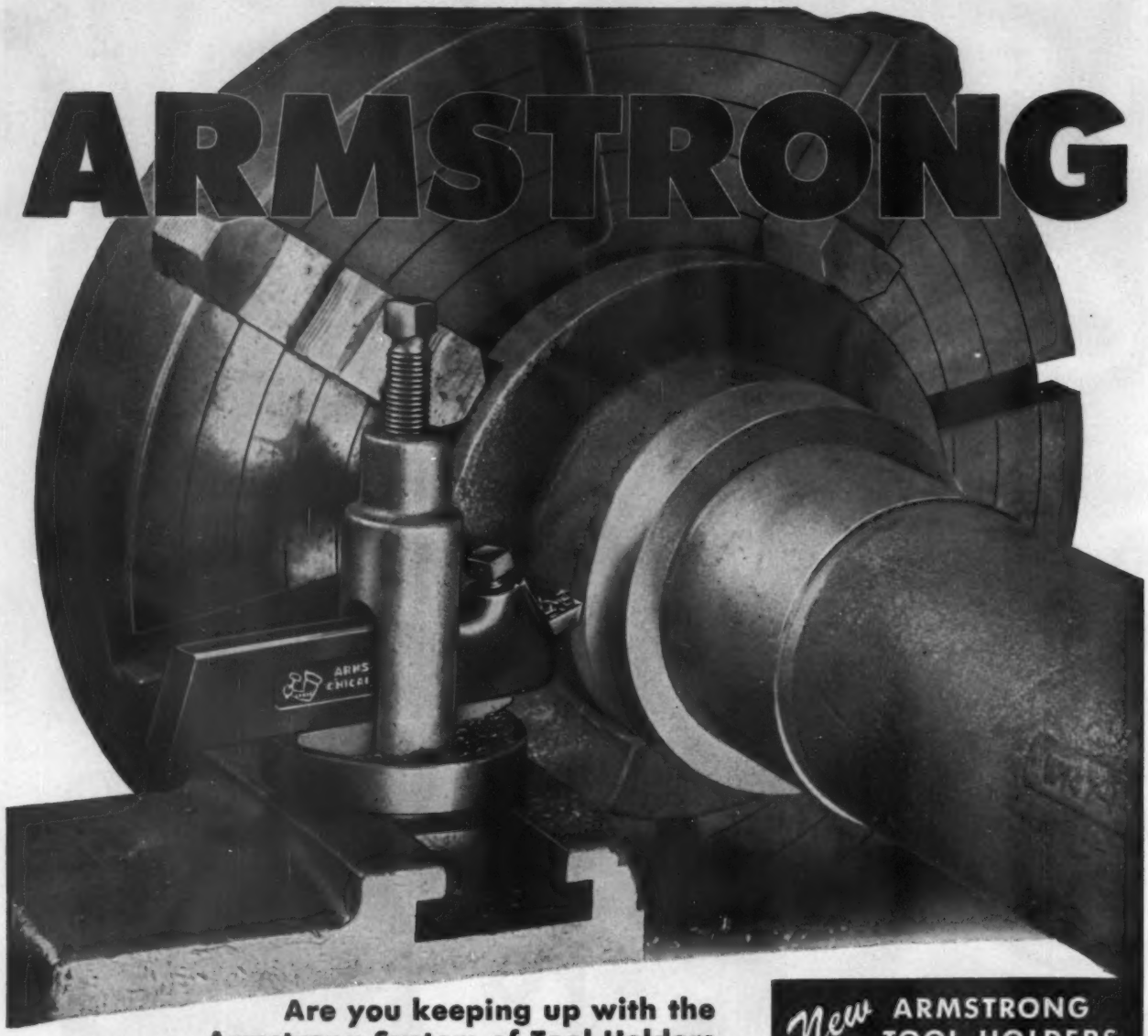
CITY_____ ZONE_____ STATE_____

ARMSTRONG

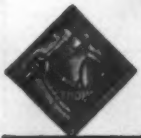


Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

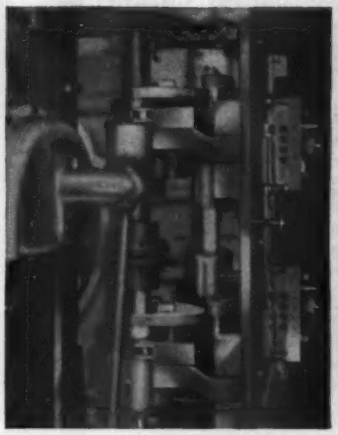
If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

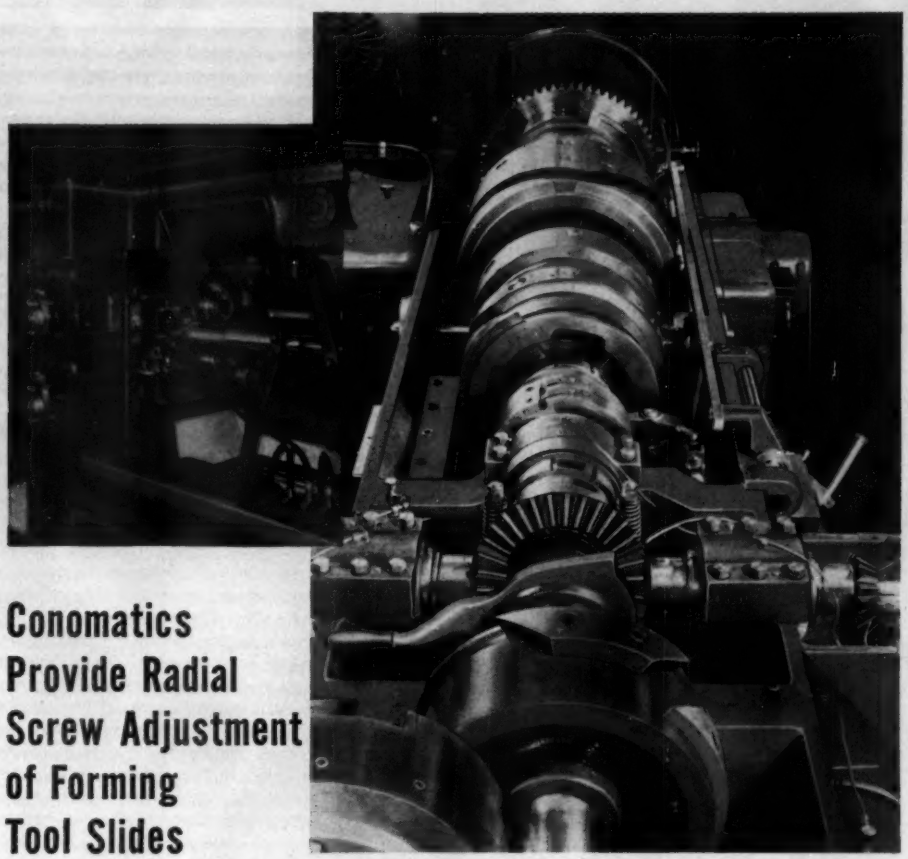


WRITE FOR CATALOG

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.



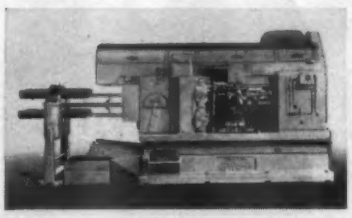


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

- Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

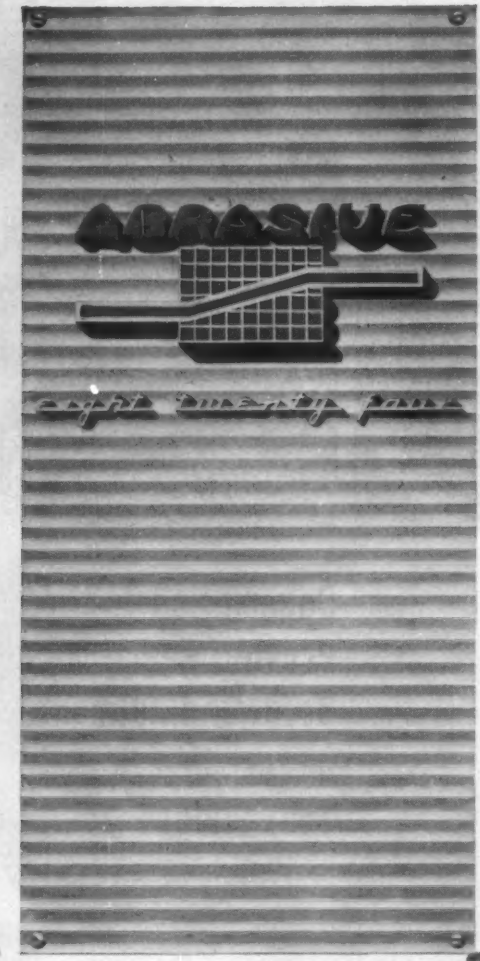
  Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

  All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes.
  Write, wire, or phone for literature.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.



You are going to see new things from

ABRASIVE

The new Abrasive name plate above gives you a hint! In 1956, our fortieth anniversary, Abrasive will introduce a number of important developments in their well known line of surface grinders. For your greatest production year, keep your eye on Abrasive pioneering in 1956.

ABRASIVE
Machine Tool Company
Dexter Road, East Providence, Rhode Island

Sorry! We can't show this revolutionary new Abrasive in detail. Look for it in 1956.

Whatever kind of gears you make...
Whatever way you make them

National Tool Co.

can supply the right type cutting tool because we make *all* types

National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

Gear Shaving Cutters

Hobs

Rack Type Gear Shaper Cutters

Gear Shaper Cutters

Involute Gear Cutters

Master Gears

Herringbone Gear Cutters

1905 • 1955 Over 50 Years

National
TOOL CO.

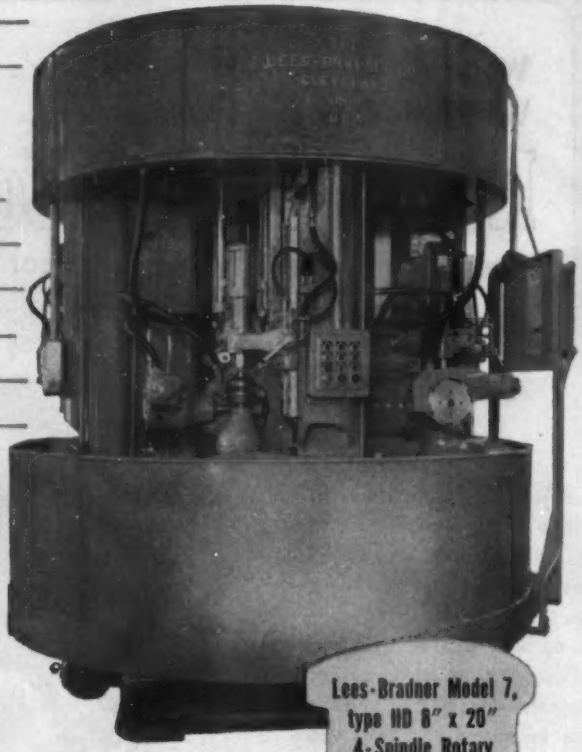
Cleveland 2, Ohio

Representatives in major industrial centers

LEES-BRADNER

Sets the HOBBING pace for tomorrow

with 4 machines in 1



Lees-Bradner Model 7, type HD 8" x 20" 4-Spindle Rotary Hobber. Also available in single and 6-spindle models.

Here's a complete hobbing production line in one space-saving unit.

Actually the Lees-Bradner Model 7, Type HD 4-Spindle Hobber is four separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 type HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H.P. motor.

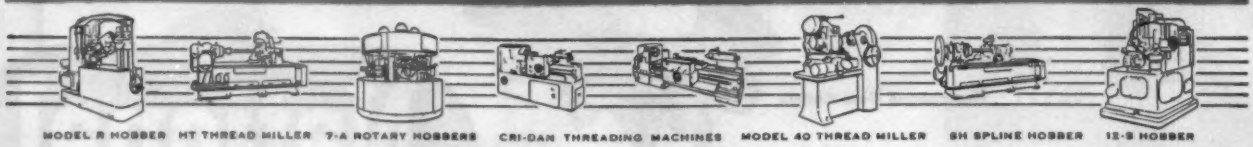
This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slowdown. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 4-spindle rotary hobber. Write or wire us direct for his name and address in your area.

View of new Type HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

the LEES-BRADNER Company

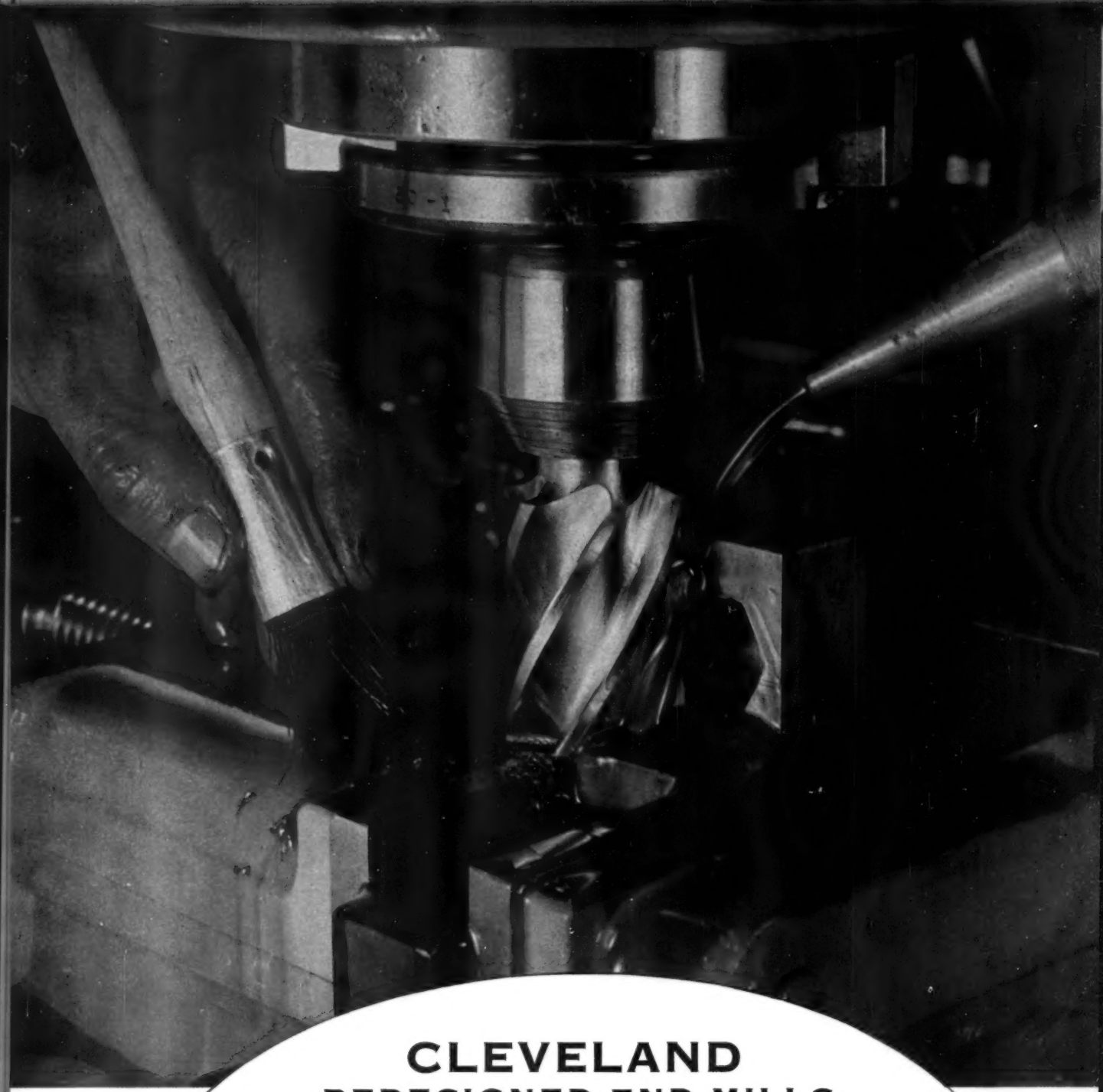
CLEVELAND 11, OHIO, U.S.A.



MODEL 8 HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · 8H SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

Cleveland 2, Ohio



CLEVELAND
REDESIGNED END MILLS

Cut faster • Clear chips better
Greater accuracy • Stronger • More durable

Engineered to give you maximum cutting qualities at greatly increased rates of feed, with a minimum amount of wear.

THE **CLEVELAND** TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

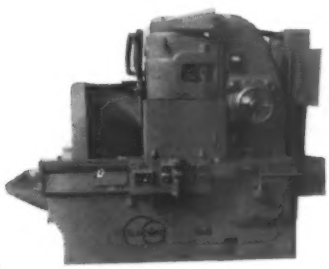
Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to ***"PUT IT ON THE BLANCHARD".***



P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

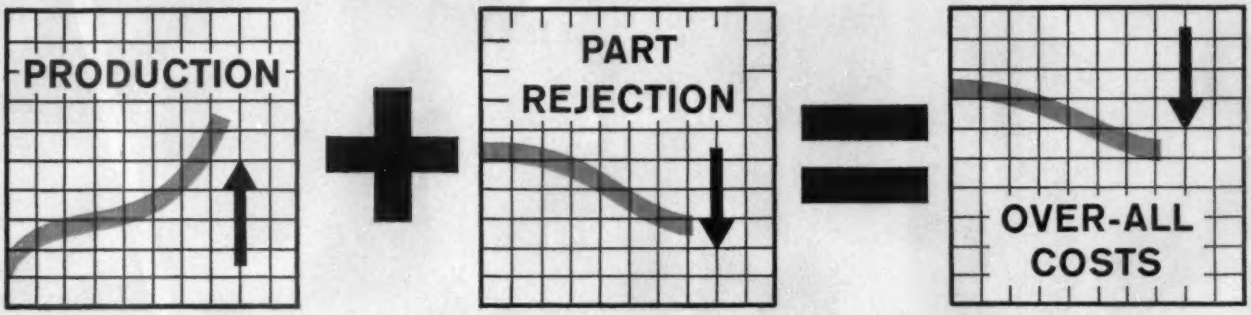
Send for free copies of "Work Done on the Blanchard"

PUT IT ON THE BLANCHARD

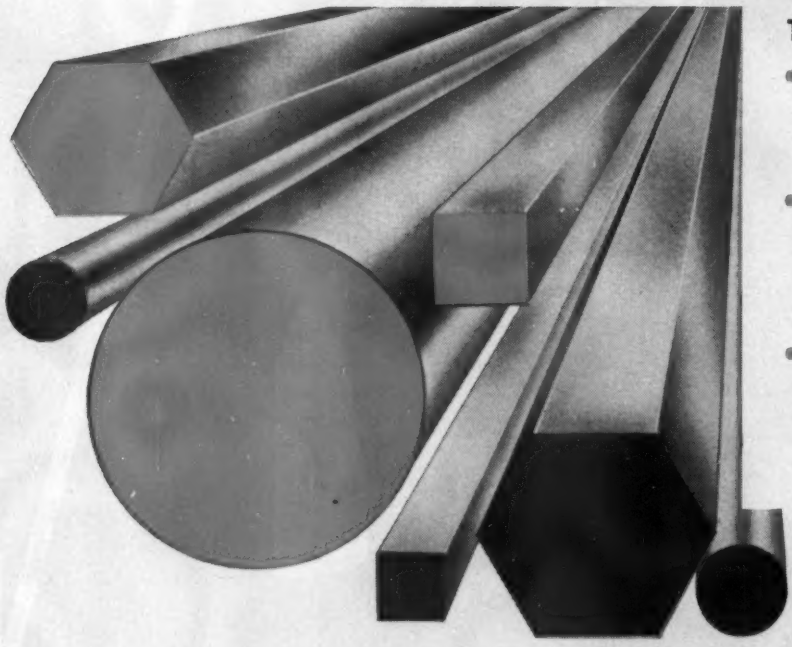
THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

J&L cold drawn leaded steel bars work to your over-all cost advantage

HERE'S HOW:



...they're free cutting and available in both Bessemer and Open Hearth grades



These versatile steel bars offer:

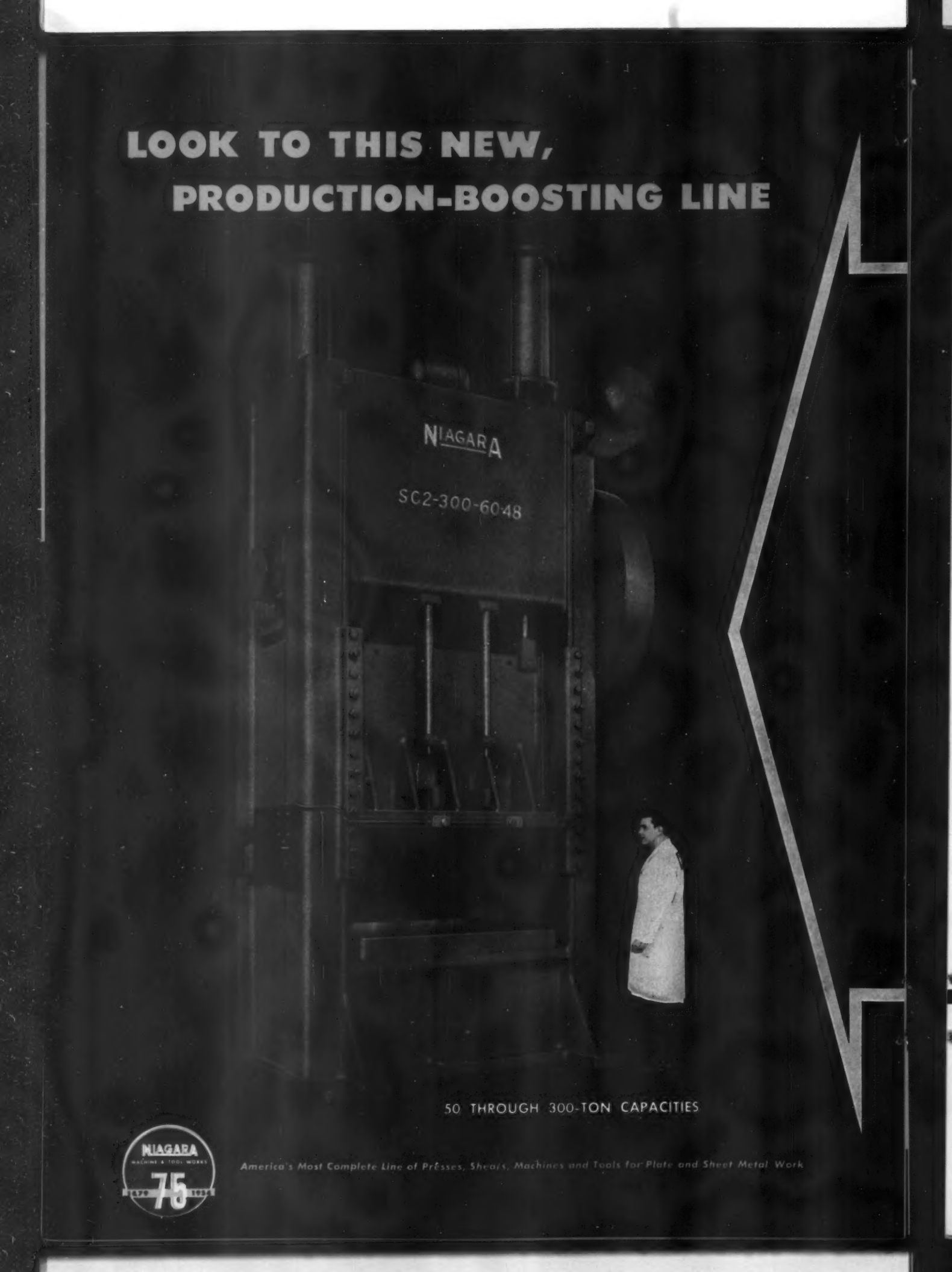
- IMPROVED MACHINABILITY—because they enable you to use faster cutting speeds, to secure longer tool life and to produce superior surface finishes.
- GREATER UNIFORMITY—because they are completely J&L-produced from the basic raw materials to guarantee optimum uniformity so necessary for today's high-speed machining operations.
- HIGHEST QUALITY—because they must meet the rigid quality standards developed by J&L through years of leadership in the development and production of free-cutting steels.

Phone the nearest J&L District office or your Distributor today.

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

J&L STEEL

LOOK TO THIS NEW, PRODUCTION-BOOSTING LINE



50 THROUGH 300-TON CAPACITIES

NIAGARA MACHINE & TOOL WORKS 1979 75 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

For a realistic answer to the metal stamping and forming problems of today... and tomorrow

DESIGN MODERNIZATION CONCEALS DRIVING MECHANISM

Fully streamlined, enclosed construction, front and back, provides pronounced advantages. There are no exposed, overhanging flywheel, clutch, brake, intermediate shaft, nor motor in rear of press to obstruct crane service, block light, throw grease and consume floor space unnecessarily ... yet all parts are quickly accessible.

WORK-SAVING FLEXIBILITY MEETS SHIFTING PRODUCTION NEEDS

Box type welded steel slides are power adjusted through self-locking, worm driven, barrel type connections to accommodate a wide range of die heights and to permit quicker, easier and safer die setting. Niagara electric clutch control provides trouble-free push button operation and a five-position selector switch for ease, safety and efficiency in single stroking, continuous running, jogging, reverse jogging and slide adjustment.

RUGGED, HEAVY DUTY FRAMES PROLONG DIE LIFE

All-steel, rigidly constructed frames, featuring an exclusive triple box section design, provide maximum resistance to deflection from horizontal, diagonal and torsional stresses. Greater accuracy and longer die life are thereby assured.

GREAT SHUT HEIGHT AND LONG SLIDE ADJUSTMENT

Unusually liberal shut height and extremely long slide adjustment, of both one and four-piece frame construction, permit use of a tremendous range of stamping and forming dies.

Hailed as the most progressive step in straight side, double crank press history, the new Niagara SC-2 Press Series could only have originated from a keen insight of today's metal working problems and the more challenging ones of tomorrow. In every detail of design, you'll recognize the unduplicated competence of Niagara engineers. Who else would be more mindful of press users' needs than the men who design and build America's leading and most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work?

CHECK THE FEATURE-BY-FEATURE EVIDENCE

Preview this complete new line of straight side presses at once. Find out what they can do for you. Write for Niagara's new, illustrated Bulletin 64-H today.

NIAGARA MACHINE & TOOL WORKS

BUFFALO 11, N. Y.

DISTRICT OFFICES:
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NIAGARA

STRAIGHT SIDE DOUBLE CRANK PRESSES

▲ L-M pond-type chain saws "bucking" log for a veneer plant.

◀ Close-up of MAX-EL alloy steel chain saw bar, showing depth of heat treatment for tougher, longer-lasting bars.

it takes MAX-EL Alloy Steel to take a beating like this

Ram the flying teeth of a chain saw against a heavy log – and watch the sawdust fly! But don't forget – backing up that speeding chain is a bar that has to absorb all the shock . . . yet keep the chain lined up accurately, dependably.

That's a big reason why leading chain saw manufacturers, like L-M Equipment Company, Portland, Oregon, specify Crucible MAX-EL® alloy steel for chain saw bars.

And there are other reasons, too. For MAX-EL is not only tough, wear-resistant and dependable . . . but it also shows outstanding response to heat treatment . . . excellent machinability . . . high uniformity . . . minimum distortion. It's these qualities that permit L-M to machine their saw bars first – *then* give them a graduated heat treatment that insures toughness at the edges . . . flexibility in the main section.

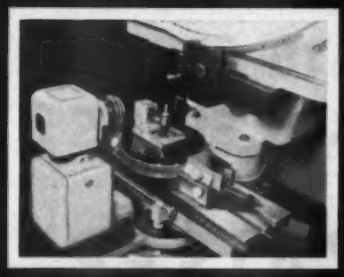
If your product requires a tough, machinable, nondeforming alloy steel – MAX-EL is for you. Try it. To see what information is available on MAX-EL – or *any* Crucible special steel – get your copy of the "Crucible Publication Catalog." Write *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

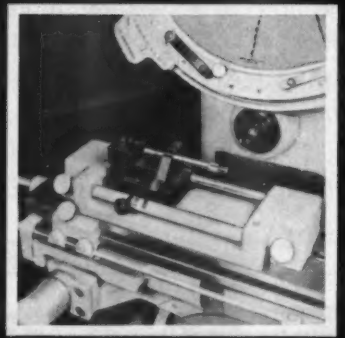
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy-to-operate



A J & L Comparator, with special fixture and chart, easily and perfectly measures a 3-dimensional cam. This is traditionally one of the most difficult of all inspection jobs.

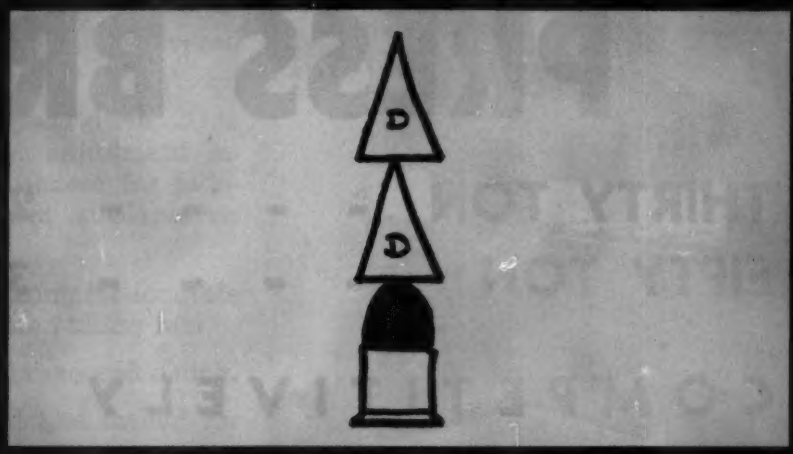
This inexpensive J & L Comparator is precisely measuring four small parts, of different sizes, with the same setup.



Shoulder lengths can be measured to closest tolerance swiftly and accurately with a J & L Comparator. The fixture shown here accommodates a wide variety of parts.

DROODLES

by ROGER PRICE



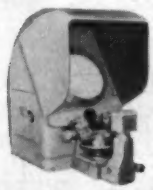
"DUMB-DUMB BULLET"

Interesting object, the dum-dum bullet. Invented by Sir Basil Fleemster, the famous explorer and hunter. A kind-hearted man, Sir Basil figured that bullets made of extra-soft lead would prove less distasteful, so to speak, to his prey.

He tested his theory on a hunting trip along the lower Zambesi. After Sir Basil had fired on a herd of antelope, his Number One bearer came running up, crying "Bad gnus, sahib — bullet holes big like soup plates!" Fleemster was so devastated by this pathetic turn of events, and the even more pathetic pun, that he hightailed it forthwith to his farm in Sussex, where he now raises peonies.

Ah, well — not the first man to be led astray by softheadedness!

Don't *you* be led astray! Be sure to get all the facts on Jones & Lamson Comparators. These precision-built optical instruments measure and inspect all sorts of objects and parts, ranging in size from the tiniest screw to large turbine blades. J & L Comparators make inspection swift and sure, with accuracy to .0001". Whatever the product or component that you make, if inspection, measurement and quality control are important in your production, it will pay you to investigate J & L Comparators. Send this coupon *today!*



Bench Model BC-14D

Pedestal Model FC-30

Pedestal Model PC-14

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vermont, U.S.A.

- ☐ Please send me Comparator Catalog 402-C (describes complete line). I'd like to see a showing of the movie(s)
- ☐ "What's the Difference" (describes Comparator construction and principles of operation)
- ☐ "Beyond the Shadow of a Doubt" (describes interesting Comparator applications)

*Name*_____ *Title*_____

*Company*_____

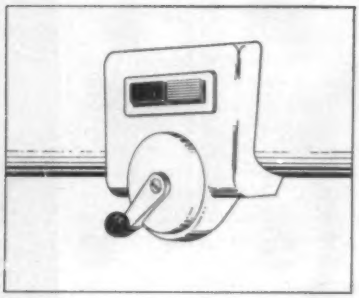
*Street*_____

*City*_____ *Zone*____ *State*_____

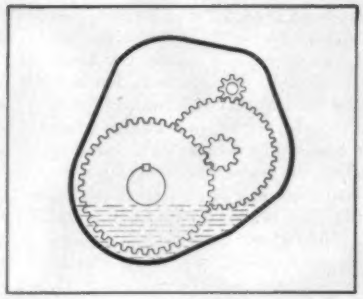
2 New CINCINNATI PRESS BRAKES

THIRTY TON - - - - 2-30 SERIES
FIFTY TON - - - - 3-50 SERIES

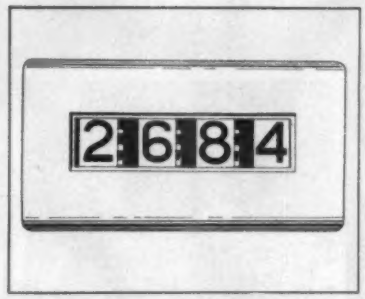
COMPETITIVELY PRICED



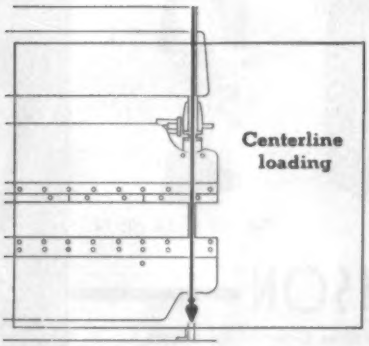
Front controlled, variable speed drive, 20 to 50 strokes per minute.



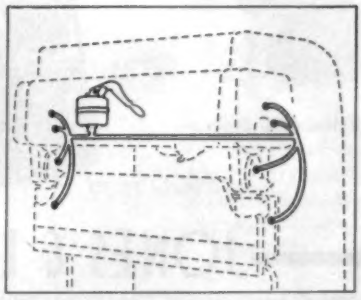
Completely enclosed transmission, running in oil.



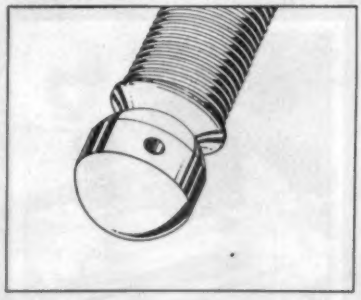
Two micrometer indicators, one at each end of the ram—easy to read and accurately record the amount of adjustment and tilt.



Centerline loading prevents weaving of the housings and insures accurate bends.



Centralized pressure lubrication system.



Ball end on the ram adjusting screws permits tapering of the ram for fade-out work.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

2-30 SERIES

This new 2-30 Series Cincinnati All Steel Press Brake has a capacity of 14 gauge x 6′ mild steel.

Look at these unusual standard features:

2½″ stroke—12″ shut height—9″ throat.

Distance between housings 5′-2″—overall die surface, 6′-0″.

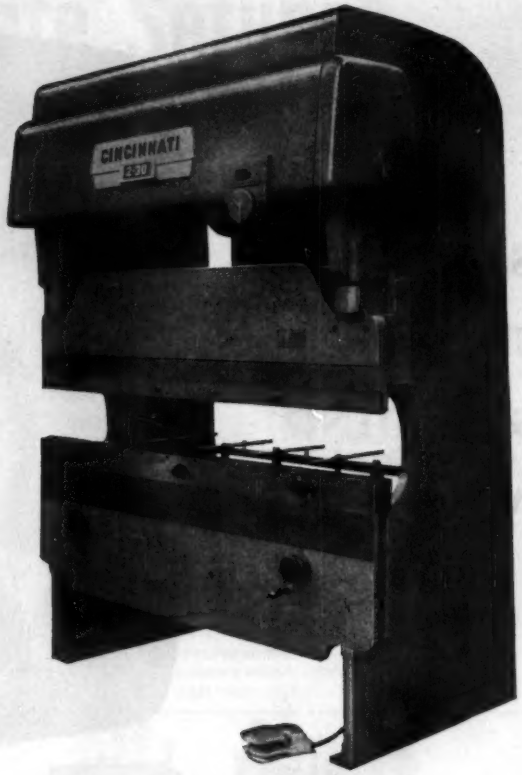
Front controlled, variable speed drive, 20 to 50 SPM. 4″ manual ram adjustment including ram tapering adjustment for fade-out work (power adjustment available as extra feature).

Bronze swivel end-guide bearing for accurate endwise alignment, even when tilting ram.

Brushless electro-magnetic brake and clutch.

Deep bed and ram, planed and drilled for 5¾″ angles.

Micrometer indicators on both ends of ram for fast, accurate setting.



3-50 SERIES

These new 3-50 Series Cincinnati All Steel Press Brakes are built in two lengths and have a capacity of 10 gauge x 6′ mild steel. Investigate these unusual standard features: 3″ stroke—12″ shut height—12″ throat—distance between housings 6′-6″ or 10′-6″—overall die surface 8′-0″ or 12′-0″—front controlled, variable speed drive, 20 to 50 SPM.

5″ motorized ram adjustment, including ram motor and control, complete with ram tapering adjustment for fade-out work.

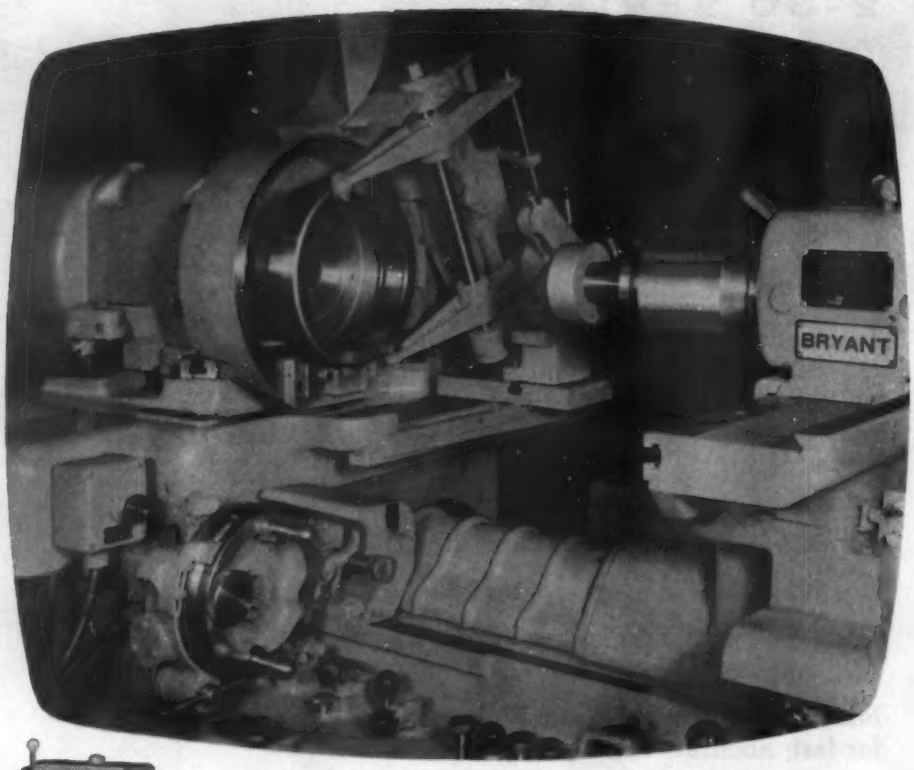
Bronze swivel end-guide bearing for accurate endwise alignment, even when tilting ram.

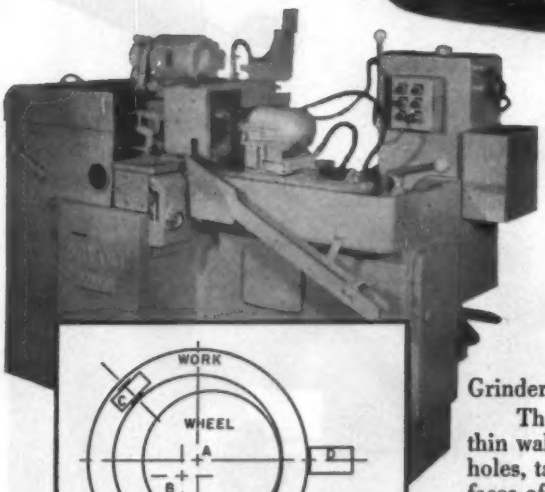
Brushless electro-magnetic brake and clutch.

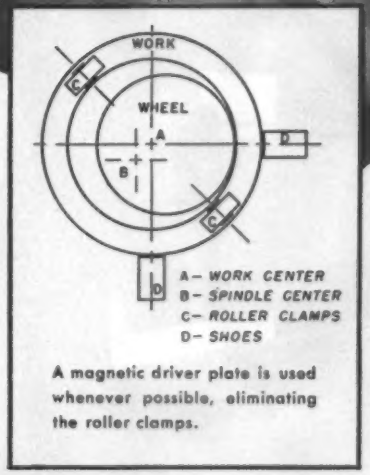
Deep bed and ram, planed and drilled for 5¾″ angles.

Micrometer indicators on both ends of ram for fast, accurate setting.

SHOE CENTERLESS GRINDING WITH...







A magnetic driver plate is used whenever possible, eliminating the roller clamps.

BRYANT internal grinders gives you HIGHER PRODUCTION and LOWER COSTS

Experience-proven tooling and fixtures help make Bryant Internal Grinders exceptionally accurate . . . efficient . . . productive.

The shoe-type centerless internal grinding fixture is typical. Extremely thin wall rings can be shoe centerless ground to close tolerances. Straight holes, tapered holes and contours, having cylindrical, conical or other surfaces of revolution can be ground by this method.

Shoe centerless grinding ensures bore grinding to a uniform wall thickness with concentricity held to less than .0001". It is particularly successful when previous O.D. and face grinding operations have been closely controlled. Distortion caused by conventional clamping is eliminated.

Shoe centerless grinding speeds up loading and unloading of work parts, whether manual or automatic. Change-over from job to job is easier and faster than with conventional grinding fixtures.

Bryant grinders offer you operating economy—as well as peak production rates. Their adjustable precision alignment helps ensure maximum original accuracy throughout their lives. They require only a minimum of maintenance. Factors like these cut cost per piece.

***WRITE** for our "Alignment" booklet. Ask, too, for a reservation card for our sound, color movie, "Alignment for Better Internal Grinding"—free showings arranged for engineering groups.*

BRYANT

chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

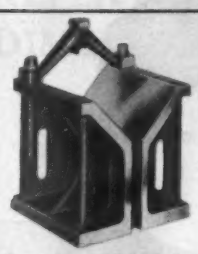
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

For Fast Accurate Setups

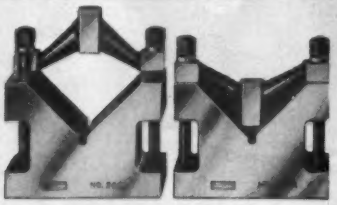
These Taft-Peirce Specialties are a 'must' for machining and inspection in the toolroom

V-BLOCKS



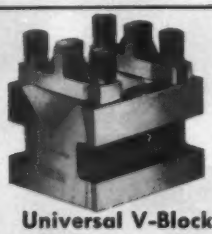
Cast Iron V-Blocks

Accurately ground to size in pairs. Made from finest quality seasoned grey iron castings. All surfaces except top are square or parallel with each other within .0005".



Steel V-Blocks

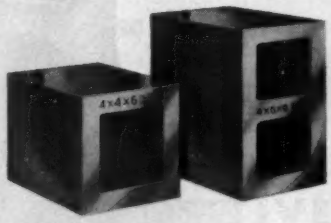
Sold in pairs only. Made of alloy steel, hardened and ground. "V" is central with sides, parallel with bottom, square with ends within .0003". All surfaces square or parallel within .0002".



Universal V-Blocks

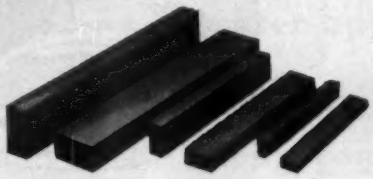
Hole in center permits quick, accurate set-ups. Also provides clearance for tool in drilling and boring. Made of alloy steel, hardened and ground on all working surfaces. All sides square within .0001". Sold singly or in pairs.

PARALLELS



Box Parallels

Made of finest quality close grained cast iron. All sizes are parallel within .00025" in 6 inches, square within .0005" in 6 inches. Will pair up within these limits.



Steel Parallels

Made of alloy steel, hardened and ground on four sides. Exceptionally durable and free from seasonal changes. Not made to be used as squares.

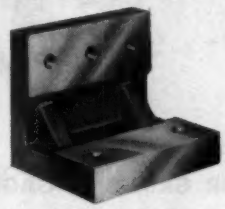
Planer and Boring Mill Parallels

Made of finest quality cast iron. Width and thickness held within plus or minus .0005". Square within .0005" in 6 inches. Parallel within .0005" in total length.

ANGLE IRONS

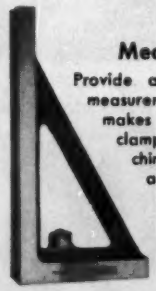
Multiplex Angle Irons

Save time by permitting a single setup of workpiece for many machining and inspection operations. All working surfaces scraped square within .0005" in 6", parallel within .0005".



Duplex Angle Irons

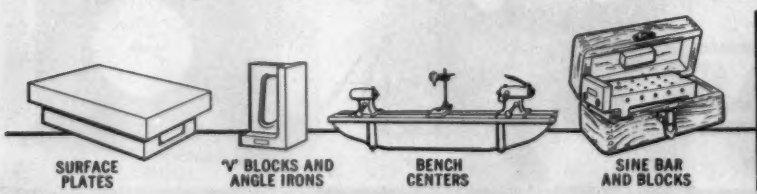
Finished inner pads increase accuracy, speed setup work and usually eliminate need for table clamping. Inner pads parallel to sides within .0005". Outer faces square within .0005" in 6".



Measuring Irons

Provide a fixed surface for measurements. Narrow width makes it convenient for clamping work on the machine table. Front face and bottom finished square within .0002" per foot.

For the complete story on these items and many more send for your copy of the Taft-Peirce Handbook.



T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

Time and Time Again . . . the

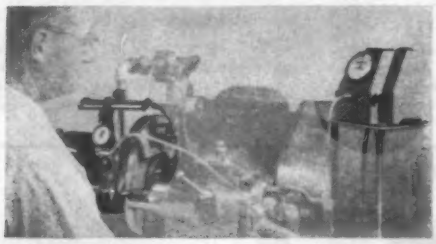
FEDERAL DIMENSIONAIR

A few of many Accessories . . .

Magnifications of 2500 to 1 with .003" usable range and 5000 to 1 with .015" usable range.

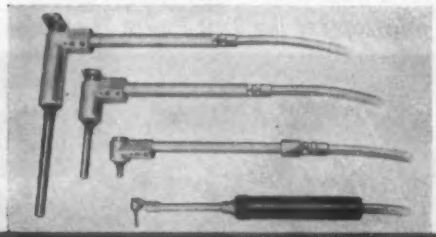
AIR PLUGS AND RINGS

AIR GRINDING GAGES



AIR SNAPS

ADJUSTABLE HOLE AIR GAGES

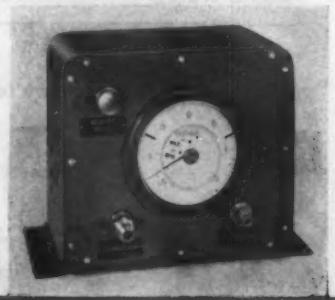


AIRPROBES

AUTOMATION AIR GAGES

SPECIAL AIR GAGES

SPECIAL AIR UNITS



Proves its Superiority!

REPEATEDLY, in direct tests with OTHER Air Gages, the DIMENSIONAIR proves itself —

MORE ACCURATE
MORE STABLE
MORE POSITIVE
LONGER WEARING

- **The DIMENSIONAIR has longest gaging range per magnification. Greater approach range, avoids scrap**
- **It's the only gage with a long, completely usable 7½" calibrated scale**
- **It's the only air gage that's not a go and no go gage: you don't just compare, you read the actual dimensional variation directly**
- **It's much faster to install, set up, and use than other air gages**

Let us put a DIMENSIONAIR in your plant so you can find out for yourself how valuable these advantages can be.

FEDERAL PRODUCTS CORPORATION • 51211 EDDY STREET, PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

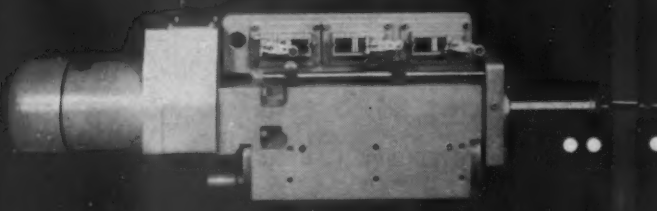
FOR RECOMMENDATIONS IN MODERN GAGES . . .

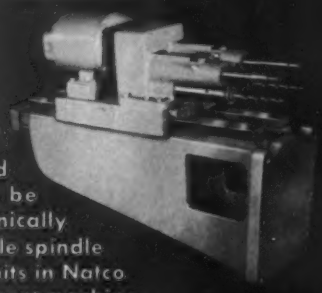
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

NATCO CUTS

EXAMPLES!

ODD ANGULAR HOLES ARE NO LONGER EXPENSIVE SINGLE OPERATIONS





NATCO DRILLING UNITS

The machining of odd angular holes can be accomplished economically by incorporating single spindle drilling or tapping units in Natco machines or your present machines.

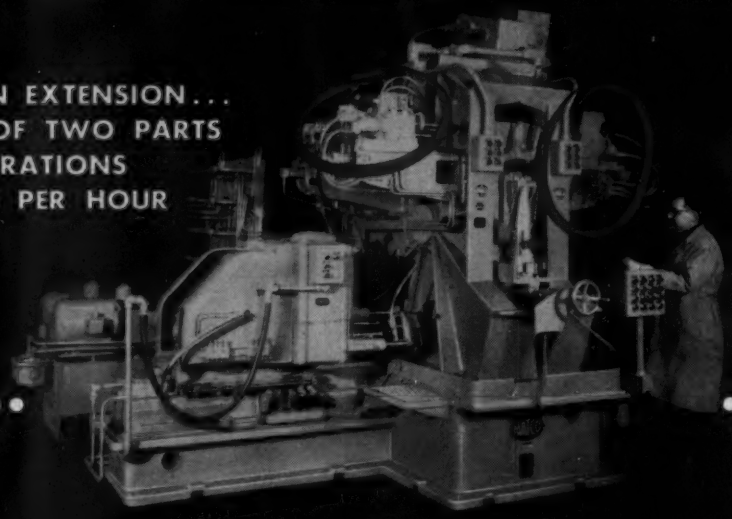
for answers to your Drilling, Boring, Facing and Tapping problems

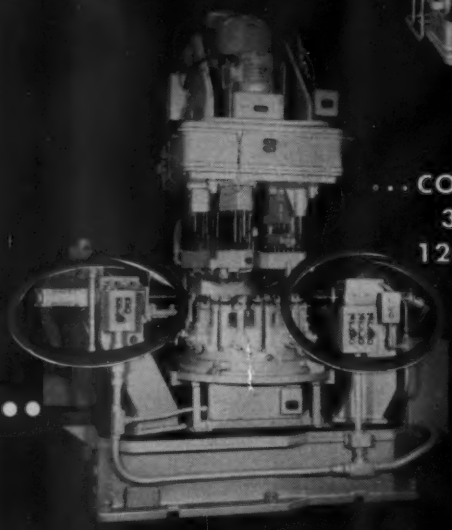
Call a Natco Field Engineer

CHICAGO, Room 203, 6429 W. North Ave., Oak Park
DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave.
NEW YORK, 35 Beechwood Ave., Mount Vernon

DRILLING COSTS

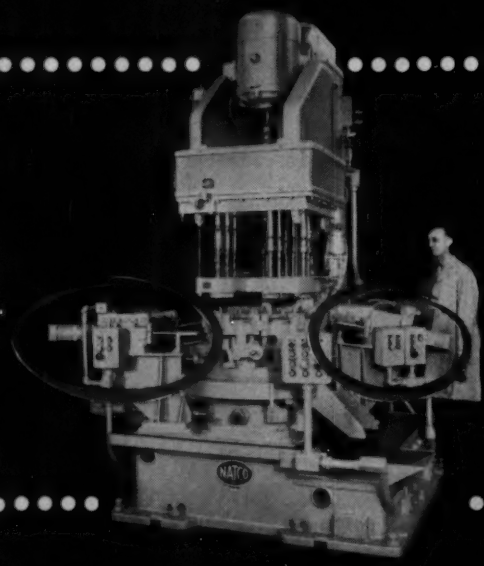
TRANSMISSION EXTENSION...
EITHER ONE OF TWO PARTS
14 OPERATIONS
120 PARTS PER HOUR





...COMPRESSOR HEAD
39 OPERATIONS
124 PARTS PER HOUR

COMPRESSOR CYLINDER...
17 OPERATIONS
80 PARTS PER HOUR



NATIONAL AUTOMATIC TOOL COMPANY, INC.

RICHMOND, INDIANA

NATCO

cut with confidence . . . **HERE'S THE**

New LeBlond Dual Drive Lathe

NEW LeBLOND DUAL DRIVE

best buy for medium duty turning

More than ever before, LeBlond's new 15″ Dual Drive lathe gives you efficient capacity at low cost for the great proportion of your lathe work.

With a single lever, the operator commands a smooth and powerful range of 16 spindle speeds from 31 to 2400 rpm. The proven combination gear-belt drive headstock provides twelve gear-driven low and intermediate speeds; 4 high speeds are driven through a positive Gilmer-type belt that requires no adjustment. The 5 hp motor is ample for all work up to that which requires the power of a heavy duty.

The new bed is rigidly ribbed and is fitted with hardened and ground replaceable steel inserts according to LeBlond's compensating veeway principle for better distribution of cutting forces. Chip pan slides in grooves, is easy to clean out. Precision under load is assured by one-piece apron design and long carriage wings with plenty of bearing. Quick-change box is totally enclosed. The tailstock is the same rugged offset-handwheel type used on all LeBlond heavy duties.

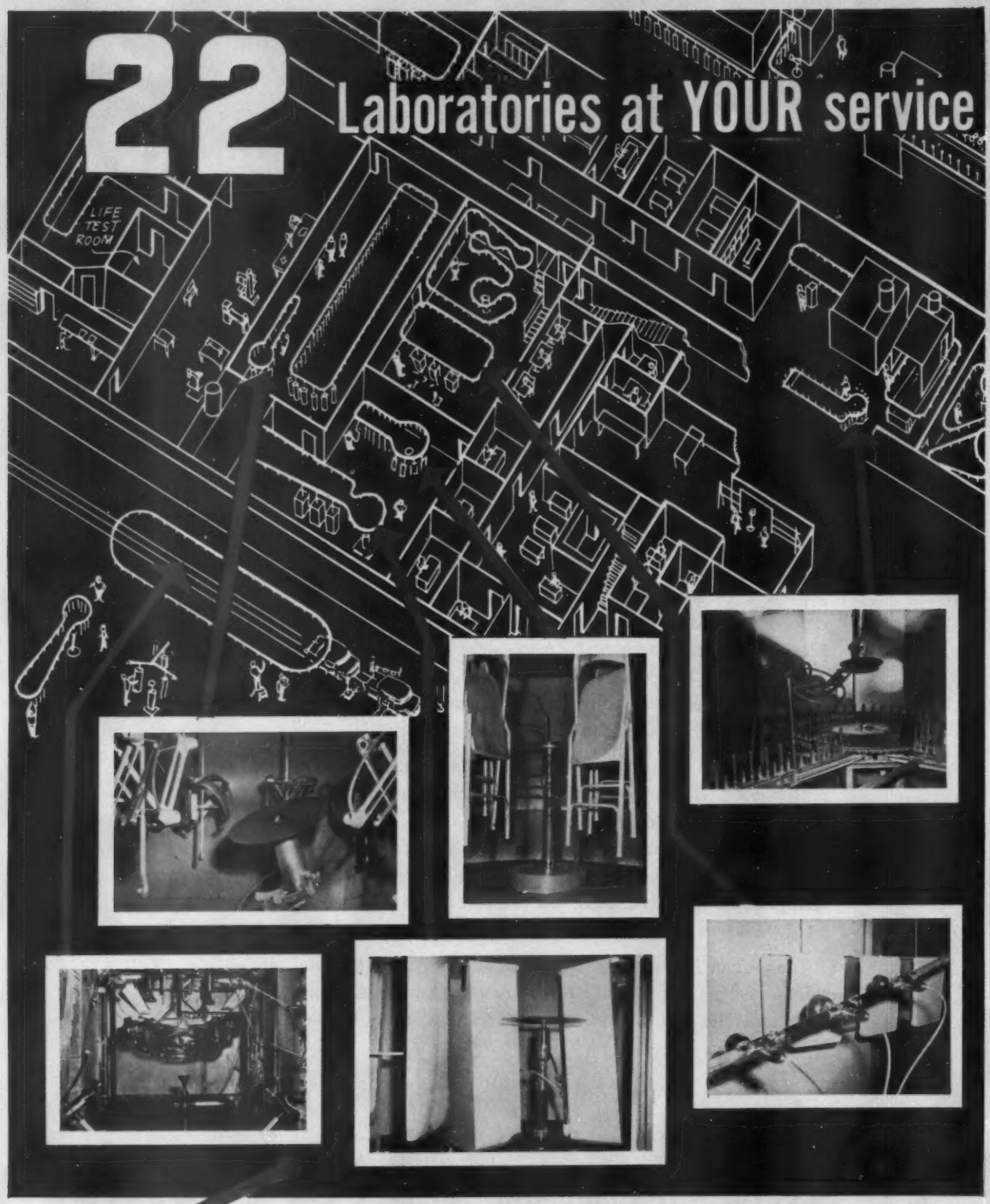
All in all, you'll find the new Dual Drive a very fine, yet moderately-priced machine that will take good care of all but the most unusual requirements. See your nearby LeBlond Distributor or write for Bulletin 6A.

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 68 YEARS*



YOUR JOB, LIKE THESE SHOWN ABOVE, WILL BE TEST PROVEN

under simulated production conditions to determine cost-saving benefits and other advantages. Ransburg also maintains other test facilities in Los Angeles, London, England; Bad Hersfeld, Germany; Paris, France and Sydney, Australia.

to prove the painting of YOUR products with

RANSBURG

Electrostatic Painting Processes

Let us make laboratory tests and prove the advantages and cost-saving benefits of painting YOUR products AUTOMATICALLY with one of the Ransburg Electro-Spray Processes.

GET THE FACTS . . . IT COSTS YOU NOTHING!

STEP BY STEP—HERE'S WHAT YOU GET...

- Survey of your plant by Ransburg's experienced field engineers, including savings estimate.
- Lab painting demonstration of your products, using equipment closely simulating your own production conditions.
- Accurate measurements of paint film thickness.
- Engineering report of detailed tests to determine paint and labor savings.
- Coated samples of your job, lab production photos, and even movies if desired.
- Detailed drawings of equipment and workholder.

All of the above without obligation to you. And, before equipment is installed you receive detailed, pre-installation instructions. Too, a well-qualified, experienced engineer supervises installation and trains your operator on the job. Ransburg offers continuing laboratory and field service to help you with any of your finishing operations.

Ransburg
ELECTRO-COATING CORP.
Indianapolis 7, Indiana

● **First,** Ransburg sales engineers will make a survey in your plant to check the possibilities of using Electrostatic Spray Painting on your products. Next, you will send samples of your unpainted products—with paint—to the Ransburg laboratories in Indianapolis.

Here, the technical staff takes over. The Ransburg Engineering staff—which includes PH.D's and Masters in Physics, Science, Electrical, Mechanical and Chemical Engineering—makes a complete study of your job. Not only do they have the necessary academic training, but they have the "know how" gained from years of actual experience in the field. Ransburg, you know, was the pioneer in Electrostatic Spray Painting 15 years ago. Engineers and well-qualified technicians have at their disposal every facility for conducting complete tests, simulating your own production conditions. They'll decide which type conveyor is best suited for your job. (There's a conveyorized lab set-up—22 in all—to handle products ranging in size from automobile bodies and chassis to small components, such as window hardware.) They'll design workholders, if necessary, and determine exactly how your job can be run to your best advantage. Details, such as fixture spacing, will be worked out too.

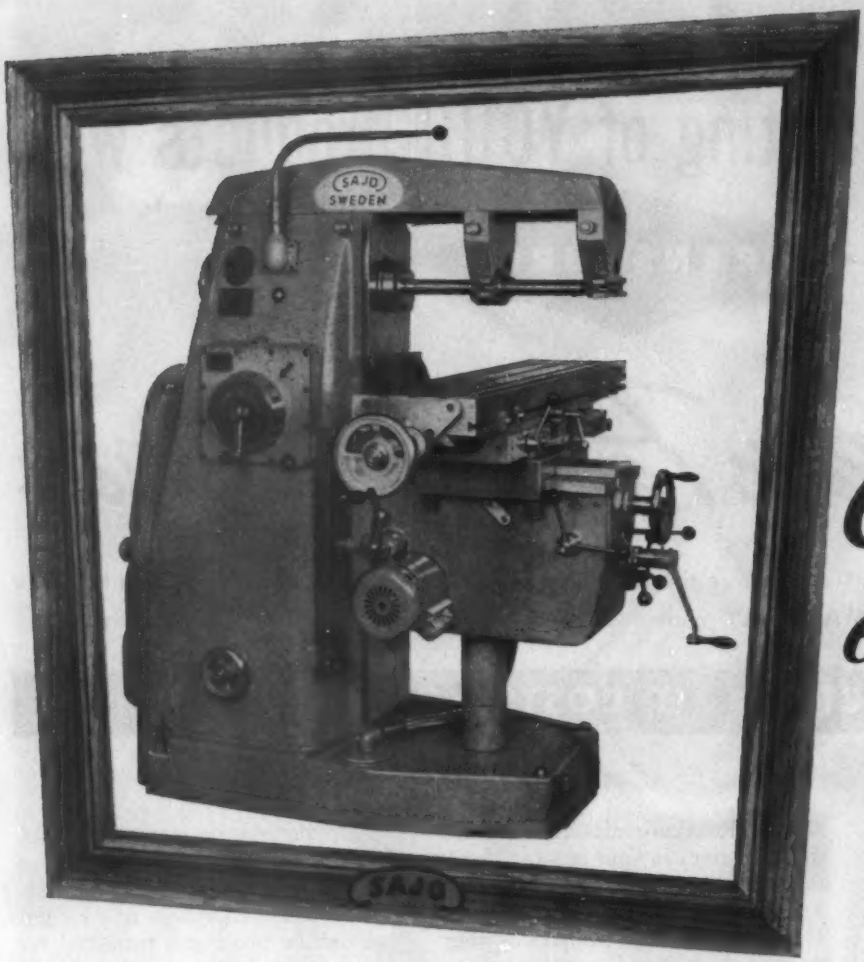
After preliminary studies and tests, you are invited to Indianapolis to see your job run in the lab. If you wish, photos and even movies of your test run can be made and furnished for your own production people to study. You see first-hand what Ransburg Electrostatic Spray Painting can do for you in your own plant.

YOU GET PAINT AND LABOR SAVINGS

Paint usage is accurately measured during the demonstration. The Ransburg No. 2 Process will provide savings up to five times the paint mileage of hand spray. And, one unit can do the work of many hand sprayers. You will see the improved, uniform quality of the work . . . you'll know what kind of increased production to expect, and you can recognize labor savings. ALL OF THIS WITHOUT OBLIGATION.

Ransburg service doesn't end there. After the equipment is installed in your plant—with our supervisory help—we will train your operator and continue to work with your finishing department. Our technically-trained field service engineers are always available to assist with any of your finishing problems.

Briefly, that's our story. Now it's your move. Call or write. Dept. AM



Classic example

OF SWEDISH CRAFTSMANSHIP

is an outstanding example of Swedish craftsmanship and fine quality materials, combined in a modern design.

Capable of continuous dependable service under the most severe conditions and guaranteeing maintenance of accuracy to tenths, the SAJO Model 54 Millers meet all requirements for:

POWER . . . . . 7½ HP motor drive to spindle (5 HP optional).
1½ HP table feed and rapid traverse motor.

RANGE . . . . . 16 spindle speeds 39-1500 RPM (optional 31-1200 RPM).
12 table feeds 11/16" to 25"/min. longitudinal and cross.
11/32" to 12½"/min. vertical.
Power rapid traverse 80"/min. longitudinal and cross. 40"/min. vertical.
Table travel longitudinal 33½". Cross 10". Vertical 18".

ACCURACY . . . . Handscraped sliding surfaces, Spindle (#50 NMT taper) mounted in four precision SKF bearings ensuring constant smooth operation and fine finish.

SIMPLICITY . . . . . Single adjustable START-STOP-BRAKE lever, Dial selection of speeds and feeds.

Priced well below levels of comparable top grade millers.

Prompt delivery. Full selection of accessories available.

Also available: SAJO No. 2 Light Duty Plain or Universal Millers.

For information write to:

austin industrial corp.

76-F MAMARONECK AVE., WHITE PLAINS, N.Y.

Dealers in principal cities

Look for the Austin Seal—your full guarantee of satisfaction.

7 benefits received by switch to STANOSTAMP *Compound C*

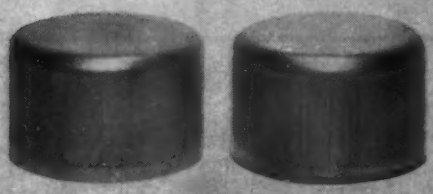
Jagemann Stamping Company, Manitowoc, Wisconsin, benefited seven ways by switching to STANOSTAMP Compound C. Finished ferrules drawn from 19 gauge cold roll steel were being badly scored. At the same time dies were being scratched and excessive heat experienced in the press. Standard Oil lubrication specialist R. E. O'Brien suggested STANOSTAMP. The result:

1. Production increased 20%
2. Die maintenance reduced 30%
3. Spoilage reduced
4. Finish improved
5. Galling minimized
6. Cooler machine operation
7. Washability improved

The results add up to this: There is a combination in the field of industrial lubrication that is hard to beat. It is (1) Standard Oil lubrication specialists capable of giving technical help and (2) Top quality products *that deliver results.*

STANOSTAMP Compound C is a water emulsifiable paste for heavy drawing operations. It contains an inert, non-abrasive mineral filler for protection of dies and work, is readily cleaned from work in conventional washing equipment. In the Midwest, your nearby Standard Oil lubrication specialist will be glad to tell you more about STANOSTAMP. Call him. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

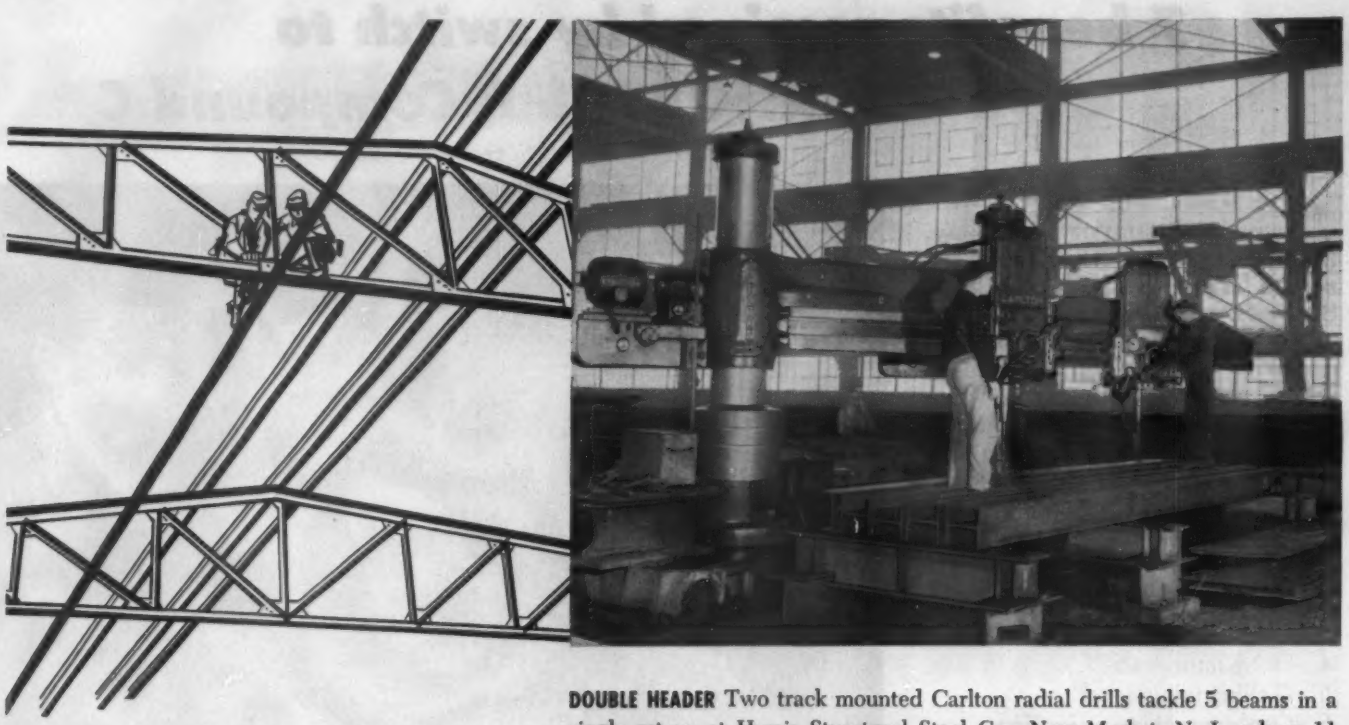
Father and son inspect ferrules. William P. Jagemann (left), President, and son William T. Jagemann note improved finish on work produced using STANOSTAMP.



Air hose ferrules. One at right produced before switch to STANOSTAMP, one at left produced after conversion to this forming compound. Scoring of dies as well as work occurred before switch.

STANDARD OIL COMPANY
(Indiana)

STANDARD



DOUBLE HEADER Two track mounted Carlton radial drills tackle 5 beams in a single set-up at Harris Structural Steel Co., New Market, N. J., where 11 other Carlton radial drills are also used for this important hole production.

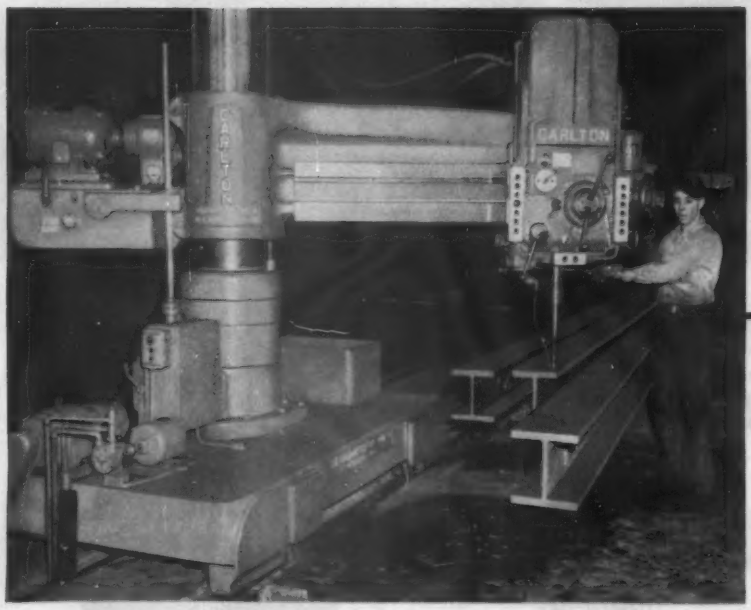
CARLTON'S ON THE

IN THE STRUCTURAL STEEL

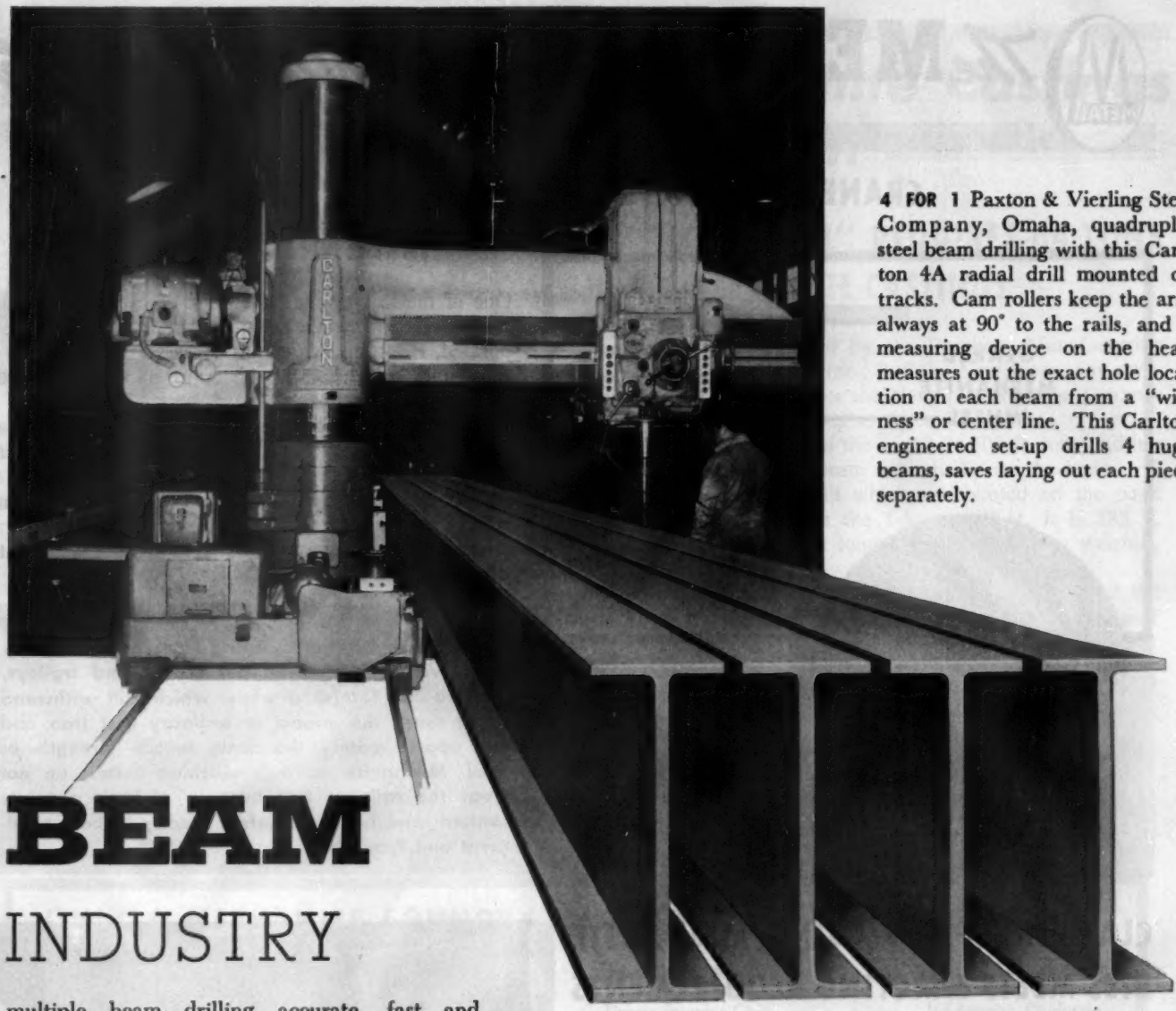
drills several beams at one setting

Mobility, king size and engineering skill have made Carlton the leading radial drill in the structural steel industry. Special track mounting takes Carlton's drilling facilities up and down the entire length of even the longest beam. And Carlton's long arm reaches out over several beams.

In addition, Carlton has engineered several ingenious and inexpensive devices which make



MOHAMMED GOES TO THE MOUNTAIN It's smarter, easier and cheaper to bring the drill to the beams. And the Carlton radial drill on wheels is just the machine tool for the job. Drills through this heavy steel beam like so much cheese . . . and there's plenty of room for three or more beams under the long Carlton arm. Photo courtesy Ingalls Iron Works Co., Birmingham.



4 FOR 1 Paxton & Vierling Steel Company, Omaha, quadruples steel beam drilling with this Carlton 4A radial drill mounted on tracks. Cam rollers keep the arm always at 90° to the rails, and a measuring device on the head measures out the exact hole location on each beam from a "witness" or center line. This Carlton engineered set-up drills 4 huge beams, saves laying out each piece separately.

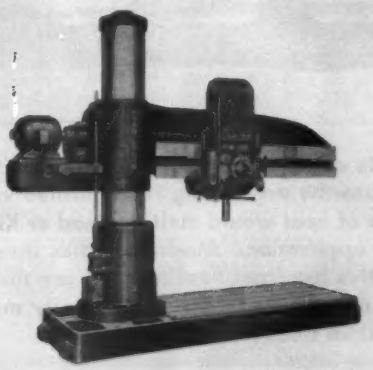
BEAM INDUSTRY

multiple beam drilling accurate, fast and practical.

Carlton brings every industry the advantage of

- a broad range of sizes: arm lengths from 3-ft. to 12-ft., column diameters from 9" to 26".
- a choice of three speed-feed control systems: programming, preselector and manual.
- an exclusive combination of standard features at no extra cost: 3-unit power clamping, low-hung drive, positive tooth feed clutch, and easy, economical operation and maintenance.

There's a Carlton radial drill, and a Carlton-engineered tooling set-up for every drilling requirement. For information on the best Carlton for you, write for descriptive bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



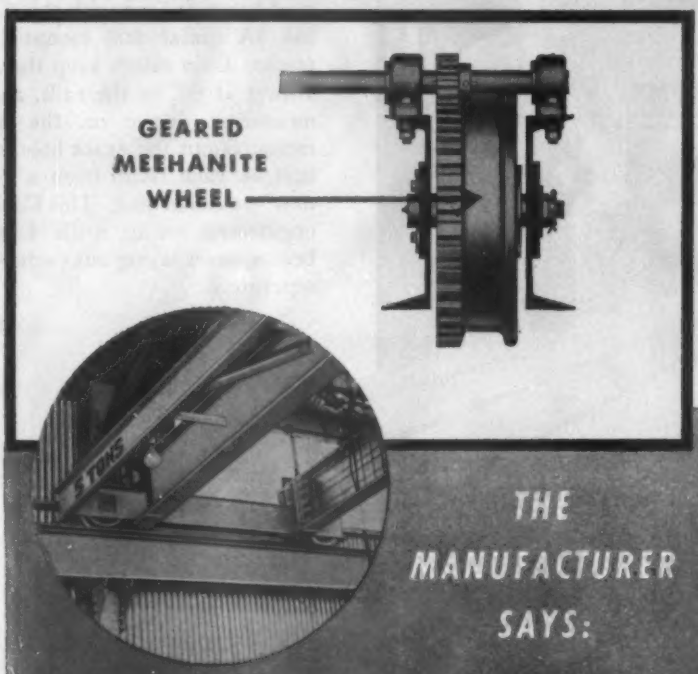
Carlton

radial and horizontal drills

Get "the hole story" . . . send today for descriptive bulletins

The MEEHANITE® Casting Reporter

CRANE MANUFACTURER REPLACES CAST IRON WHEELS WITH MEEHANITE METAL®



One of the leading manufacturers of overhead traveling cranes, crane runways, hoists, and trolleys, Lypta, Incorporated, Houston, Texas, has standardized on specifying Meehanite metal for all the crane and hoist traveling wheels it manufactures.

In the search for better performance, the company found Meehanite cast and machined wheels to be better than those of cast iron or "car wheel iron" from the standpoint of strength, and better than steel because wheels made of Meehanite metal running on steel rails do not cause the noise made from the contact of steel wheels on steel rails.

THE MANUFACTURER SAYS:

"We have found that by using Meehanite metal for the traveling wheels on our cranes and trolleys, that we can furnish a wheel which will withstand seven times the impact of ordinary cast iron and has approximately the same tensile strength as steel. Meehanite castings machine better; do not wear the rails as fast because of their graphite content; and lend themselves readily to heat treatment and flame hardening."

CLAMPING PRESS USING MEEHANITE DIES MEETS EXACTING REQUIREMENTS

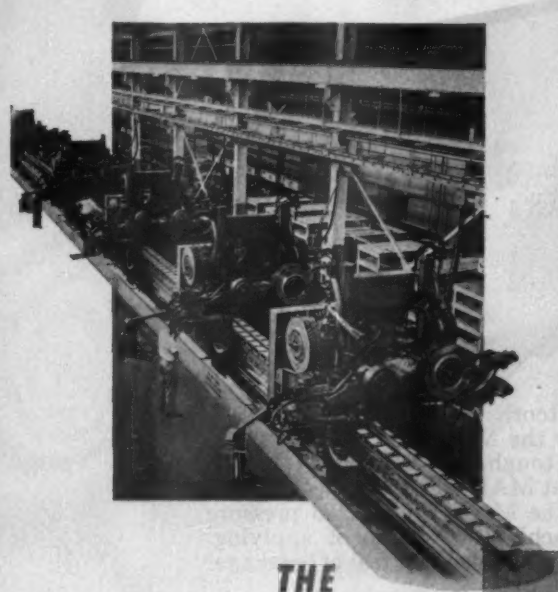
One of the operations involved in the making of exhaust systems for the Pratt & Whitney Aircraft Wasp Major engine at the plant of the Ryan Aeronautical Company, San Diego, California, is spot-tacking two large stainless steel half-stampings together with an arc welder. Savings in scrap loss, time and money were achieved by building special clamping presses which incorporated Meehanite dies.

As shown here, the welder using this clamping press inserts an arbor in the half-stampings, then brings the Meehanite dies down within contact thus being assured of an exact, close-fitting connection between the two half-stampings. The welder then arc-tacks the half-stampings together at the flange area.

THE MANUFACTURER SAYS:

"Meehanite metal was selected as the die material because it best meets the specific requirements for this work. Because the arc-tacking is performed very close to the dies, the localized application of heat would melt the lead or Kirksite alloys which are often used in such applications. Meehanite dies do *not* melt nor distort from the application of this localized heating, and are therefore excellent for these exacting requirements. Also, it is substantially more economical to use Meehanite dies rather than steel."

Industries report what Meehanite Castings have done for them



FARNHAM "LONG MILL" REQUIRES 64 TONS OF MEEHANITE CASTINGS

The development of the Long Mill by the Farnham Manufacturing Division of the Wiesner-Rapp Co., Inc., Buffalo, New York, has revolutionized the milling of spar caps for the Navy planes at the Torrance Facility, El Segundo Division of Douglas Aircraft Co., Inc.

This mill, the largest of its kind in the world, is 308 ft. long and has eight integrated carriages which operate individually on the bed.

The sub-base or work-holder unit which is mounted on the basic bed was designed and fabricated in the Torrance plant. It is 288 ft. long and composed of 72 four-foot long Meehanite castings weighing a total of 64 tons.

After assembly on the machine bed, the 18-in. wide surface of the work-holder unit was machined to insure parallelism with the warp of the machine.

THE MANUFACTURER SAYS:

"Meehanite castings were specified for this Farnham Long Mill because the requirements called for castings of high tensile, non-deforming metal that had good machining characteristics and that would withstand shock loads without surface marring."

ONLY A MEEHANITE FOUNDRY CAN MAKE MEEHANITE CASTINGS

The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
Banner Iron Works	St. Louis, Missouri
Barnett Foundry & Machine Co.	Irvington, New Jersey
Blackmer Pump Company	Grand Rapids, Michigan
Compton Foundry	Compton, Calif.
Continental Gin Co.	Birmingham, Alabama
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio & Grove City, Pa.
Crawford & Doherty Foundry Co.	Portland, Oregon
DeLaval Steam Turbine Co.	Trenton, New Jersey
M. H. Detrick Co.	Newark, N. J. and Peoria, Ill.
Empire Pattern & Foundry Co.	Tulsa, Oklahoma
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Georgia Iron Works Co.	Augusta, Ga.
Greenlee Foundry Co.	Chicago, Illinois
The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Hardinge Company, Inc.	New York, New York
Hardinge Manufacturing Co.	York, Pennsylvania
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Koehring Co.	Milwaukee, Wisconsin
Lincoln Foundry Corp.	Los Angeles, California
Palmyra Foundry Co., Inc.	Palmyra, New Jersey
The Henry Perkins Co.	Bridgewater, Massachusetts
Pohlman Foundry Co., Inc.	Buffalo, New York
Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
Ross-Meehan Foundries	Chattanooga, Tennessee
Shenango-Penn Mold Co.	Dover, Ohio
Sonith Industries, Inc.	Indianapolis, Ind.
Standard Foundry Co.	Worcester, Massachusetts
The Stearns-Roger Manufacturing Co.	Denver, Colorado
Traylor Engineering & Mfg. Co.	Allentown, Pennsylvania
Valley Iron Works, Inc.	St. Paul, Minnesota
Vulcan Foundry Company	Oakland, California
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Write for your copy of "The Handbook of Meehanite Metals"

This Advertisement Sponsored by Foundries listed above

MEEHANITE METAL® CORP.

714 North Ave., New Rochelle, N. Y.

Features Essential to Top Hack Saw Blade Performance

UNBREAKABLE—to saw FASTER.

Composite construction (a narrow high speed steel tooth edge electrically welded by the MARVEL-invented process to a tough, non-brittle alloy steel body), means that MARVEL high-speed-edge can be subjected to the MAXIMUM feed pressure that any hack sawing machine is capable of applying. MARVEL blades need not be "babied" for fear of breakage!

SHATTERPROOF—for SAFETY.

MARVEL blades never shatter or "explode" as do the ordinary "brittle" blades shown at left which so often cause personal-injury accidents such as the loss of an eye or severe laceration and expensive damage to the sawing machine. Operators who use MARVEL blades exclusively soon "get the habit" to apply heavier feeds, greater blade tension, higher speeds—to do their work faster, because they know they are SAFE with MARVEL.

SHARPER, PREMIUM-STEEL TEETH—to wear LONGER.

Teeth are accurately machined by a MARVEL-invented process that assures sharper tooth points and positive uniformity of tooth shape and degree of set from end-to-end of every MARVEL blade. The steel used in the tooth edge is carefully selected from the finest high speed steels available throughout the world, regardless of cost or source—truly premium steels, without premium cost.

QUALITY CONTROL—to assure UNIFORMITY.

With more than a quarter century of *experience* in inventing, perfecting, and producing welded-edge hack saw blades, MARVEL has provided its own laboratory with the most modern metallurgical instruments and techniques known to the applicable sciences for the specific purpose of maintaining highest possible quality control. Coupled with rigid tests and meticulous inspection of every MARVEL blade, uniform quality is assured.

These are only a few features that make MARVEL High-Speed-Edge Blades such outstanding performers.

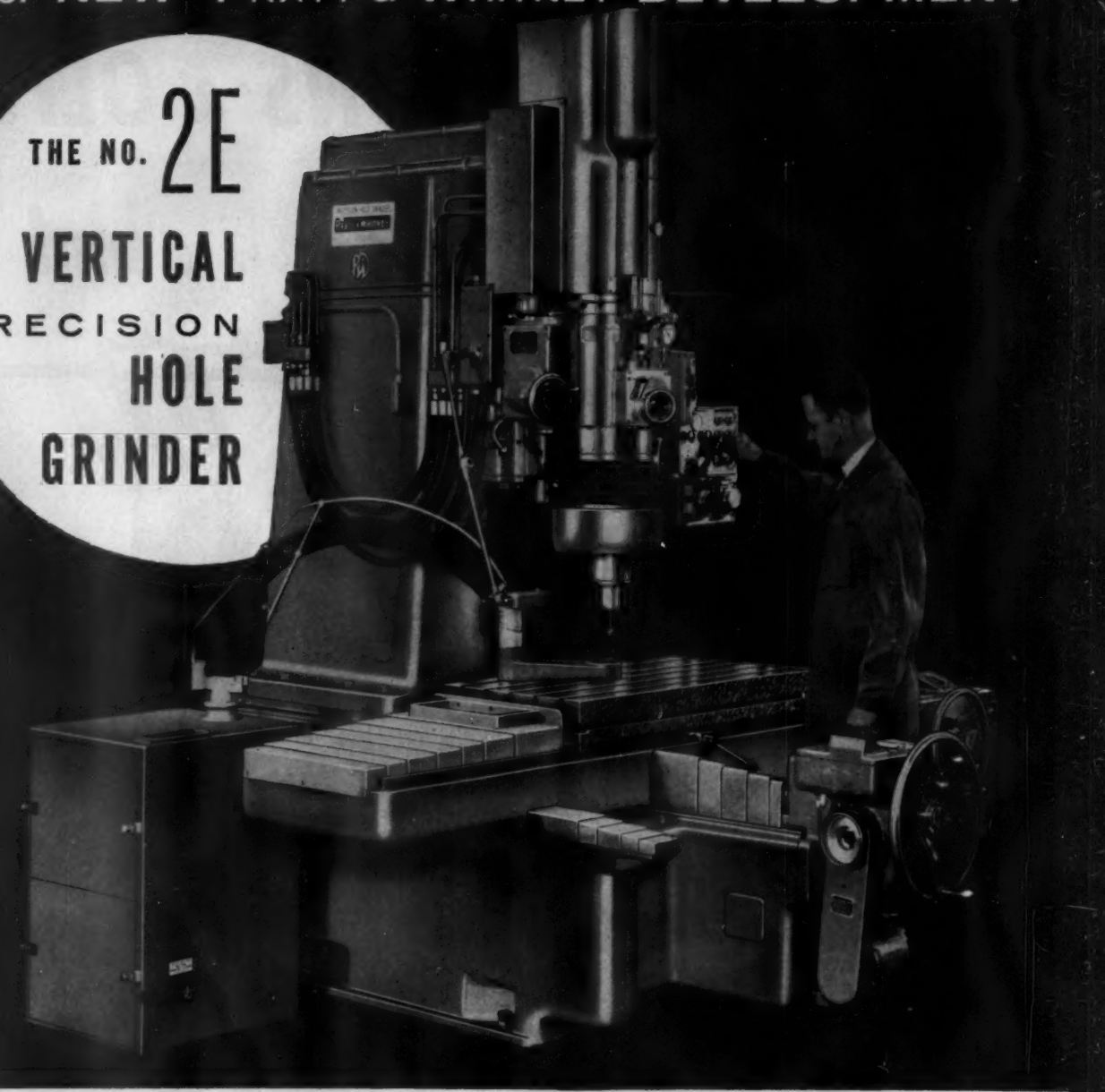
Ask for the latest MARVEL Cutting Tool Bulletin and the name of your closest MARVEL Distributor.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

Manufactured only by
ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

Another NEW PRATT & WHITNEY DEVELOPMENT

THE NO. 2E VERTICAL PRECISION HOLE GRINDER



- **EXTREMELY ACCURATE . . .** Incorporates the famous P & W Electrolimit Measuring System. Table settings accurate to .0001". Grinds straight or tapered holes and radii with extreme accuracy.
- **HIGH GRINDING SPEEDS . . .** Pneumatic grinding heads, of unique air bearing design, provide speeds from 4,000 to 100,000 rpm. Governor effectively maintains speed settings regardless of load changes.
- **FAST, SIMPLE, ECONOMICAL OPERATION . . .** Unlike conventional bore grinders, the 2E holds work stationary; grinding head has planetary motion around axis of hole. This — combined with fast, accurate table locating system — permits grinding holes of various sizes in a workpiece to close tolerances for size and location in a single setup. Controls for all machine motions within easy reach of operator. Time and costs are minimized.
- **VERSATILE . . .** Grinds holes up to 10" dia. Big table (22" x 44") with P&W open-side construction easily accommodates large or odd-shaped work. By adding a P&W Precision Rotary Table, any simple or compound angle can be located and ground without special fixtures.
- **DURABLE-DEPENDABLE . . .** All slide ways are protected by telescoping guards. Entire machine is designed and built to minimize wear and to retain its original high accuracy and rigidity year after year.

PRATT & WHITNEY COMPANY
INCORPORATED
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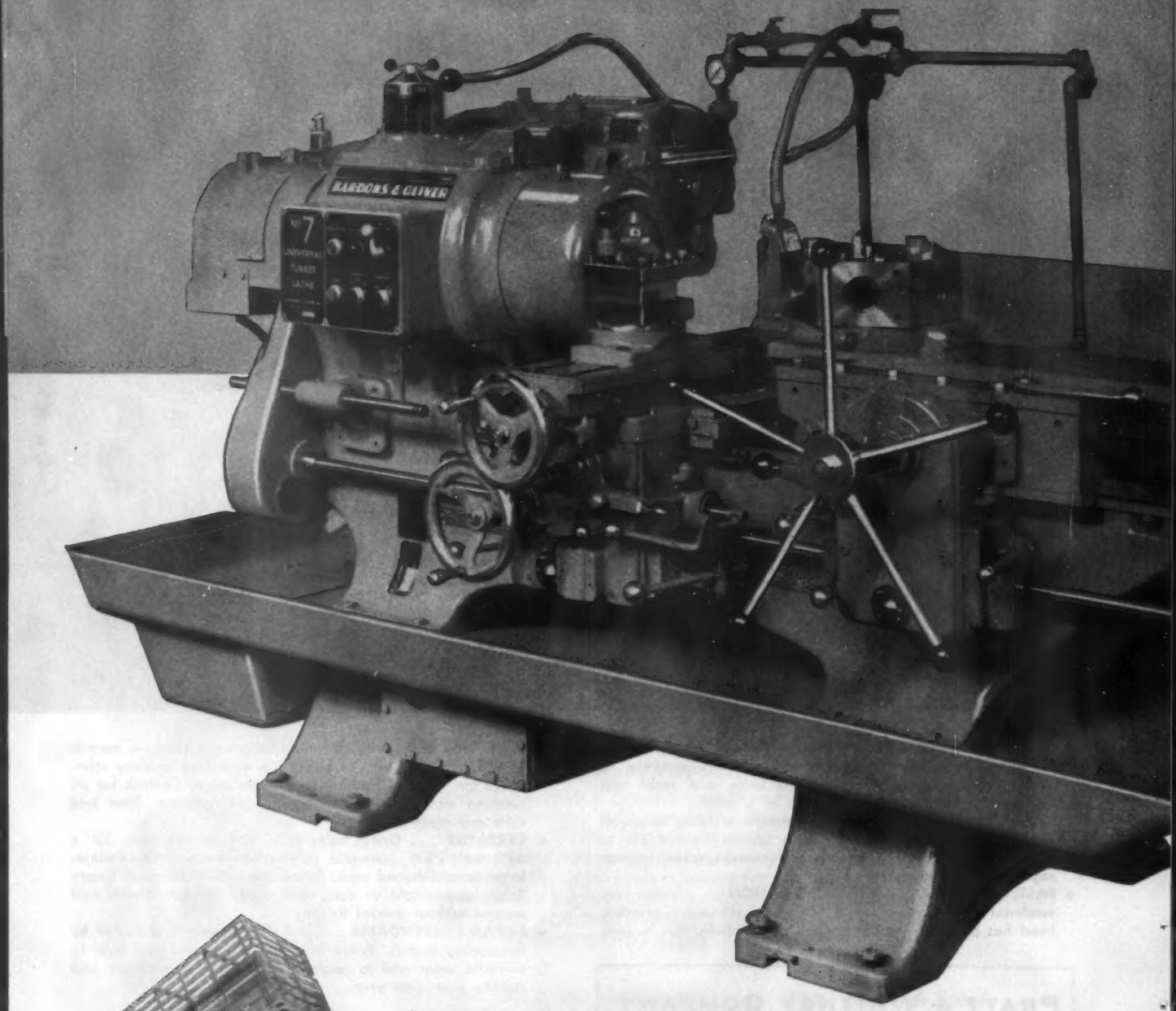
(4½" CAPACITY)

4 other machines . . . and . . .



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TURRET LATHES Eliminate combine 12 operations . . . at . . .

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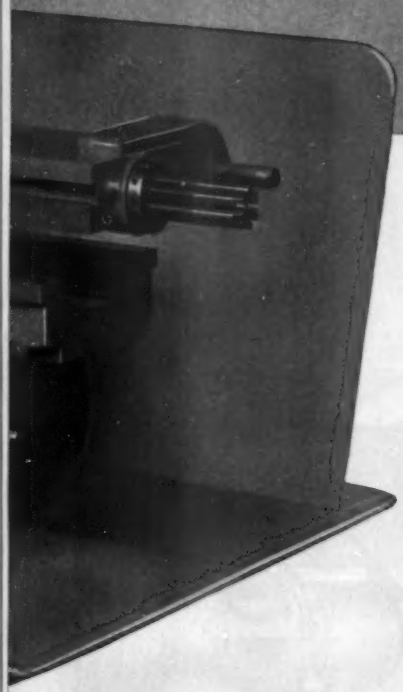

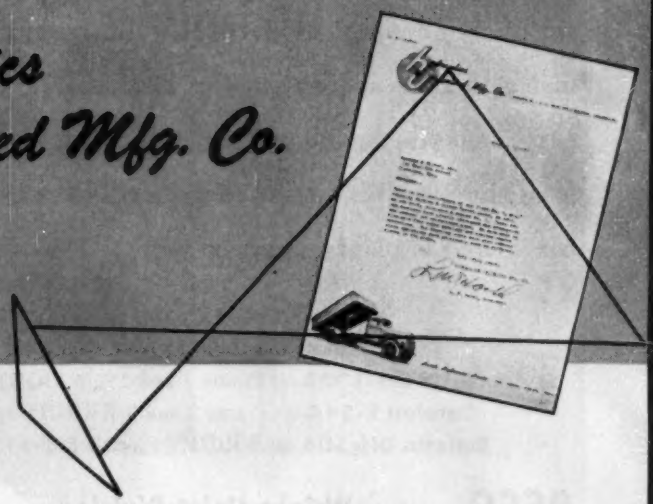

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L. W. Harsh, President

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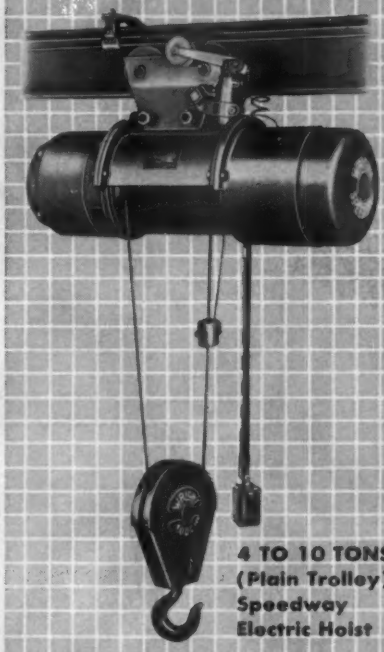

4 TO 10 TONS—
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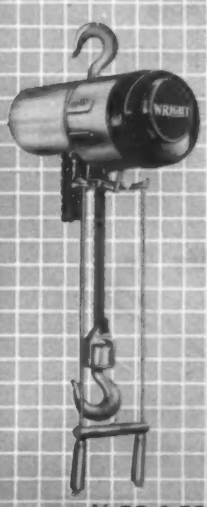
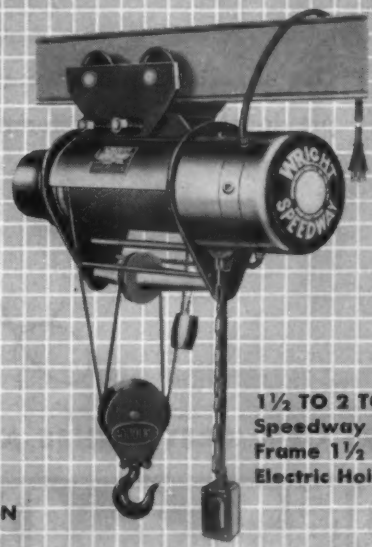
Electric Hoist

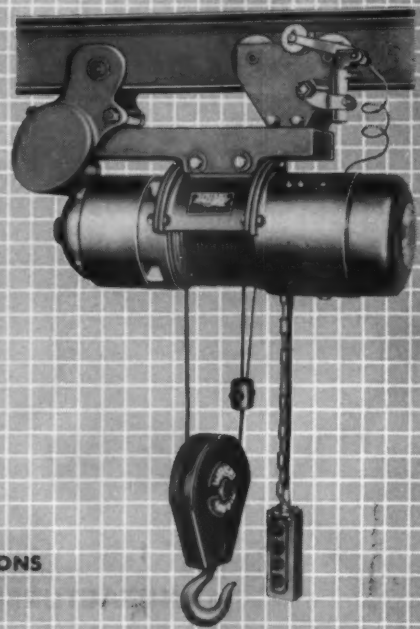


¼ TO 2 TONS
WRIGHT Electric
Roller Chain Hoist

¼ TO 1 TON
Speedway
Frame 1
Electric Hoist



1½ TO 2 TONS
Speedway
Frame 1½
Electric Hoist



½ TO 6 TONS
(Motor Driven Trolley)
Speedway
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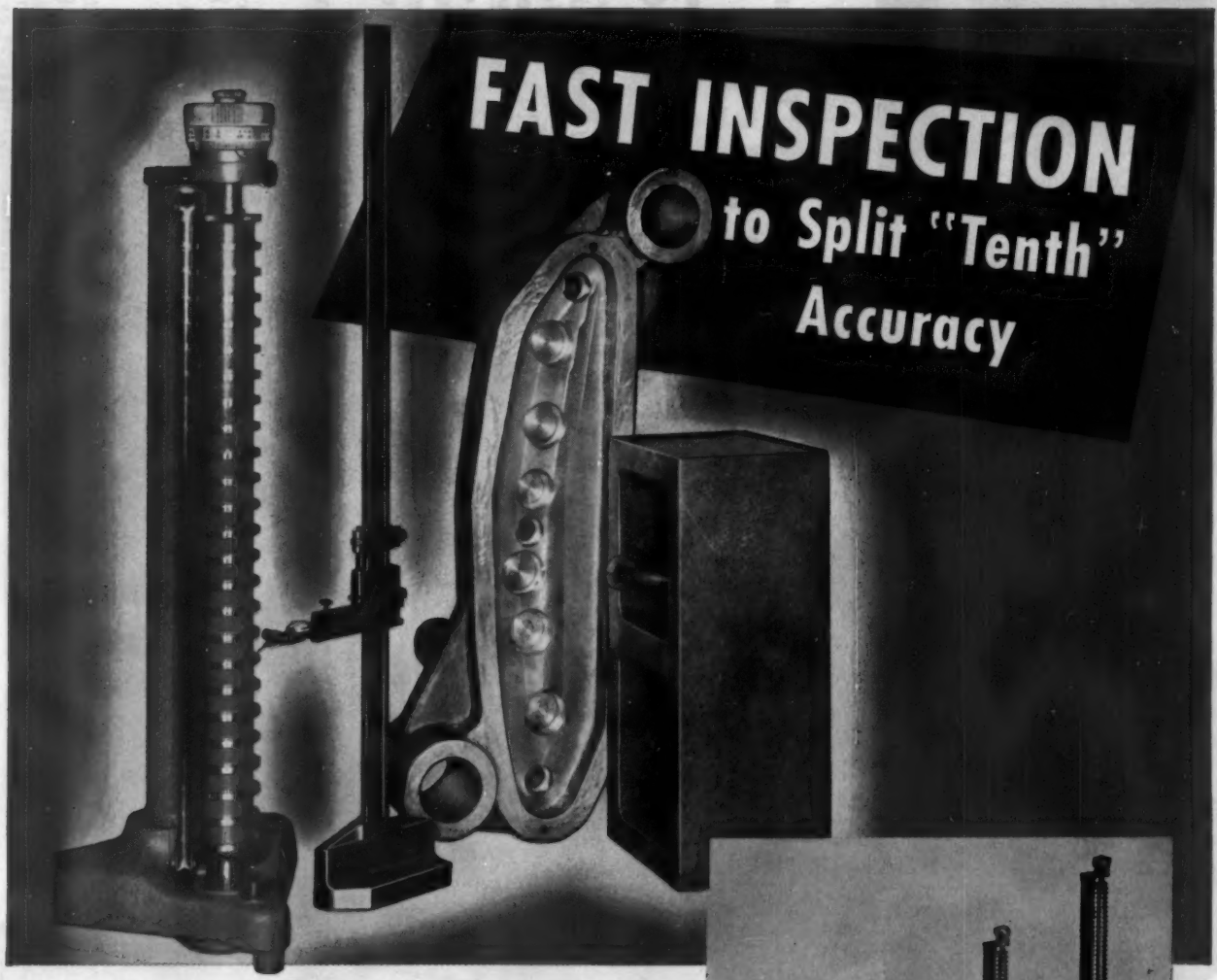

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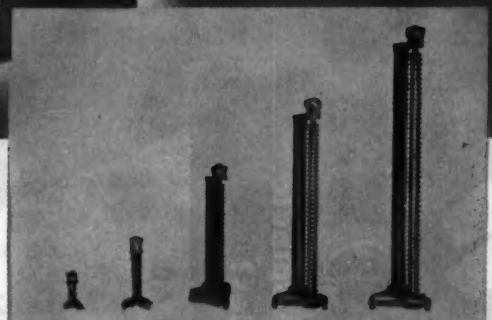

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. . . obsolete all other single spindle automatics of comparable capacities!

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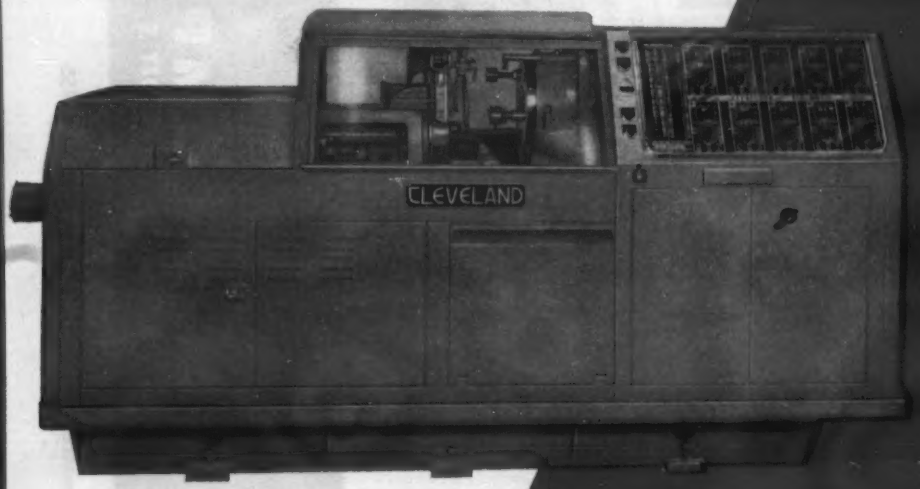
CLEVELAND DIALMATICS

WITH ELECTRONIC TURRET TOOL FEED DRIVE AND ELECTRONIC INFINITELY VARIABLE SPINDLE SPEED DRIVE



Spindle speeds and turret tool feeds are . . .

COMPLETELY DIAL CONTROLLED

CONTROL PANEL DIALS enable you to *pre-select* highly accurate and infinitely variable forward and reverse *spindle speeds* and forward and return *tool feeds* for each of five turret positions. Each tool is completely and individually controlled throughout the cycle. Each control is not bound to any preceding or succeeding control in any way. There are no turret feed cams—no change gears. You simply *set* the dials to obtain the *optimum* feed and spindle speed for maximum productivity of each working tool!

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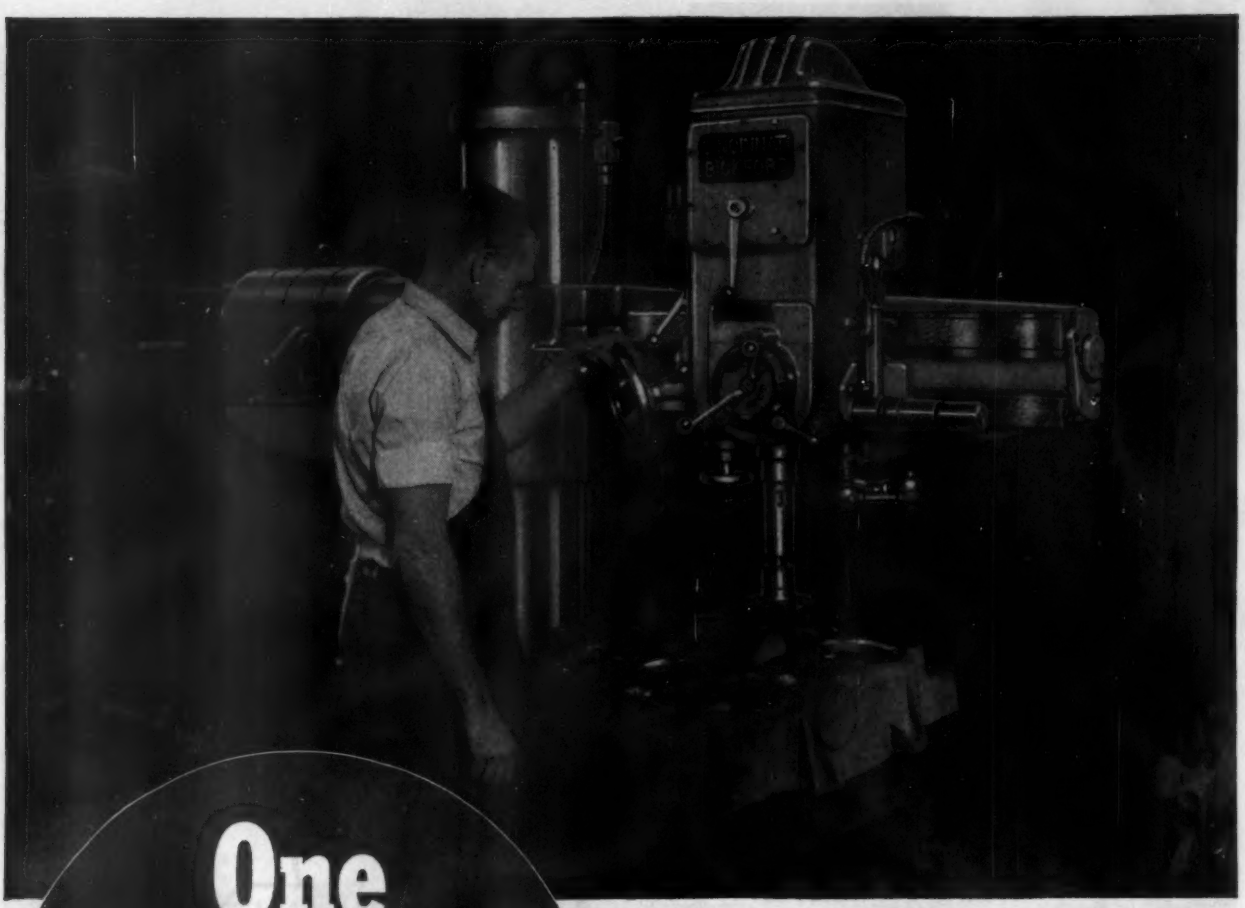

One set-up saves 30%

Photos courtesy of the Kelman Electric & Mfg. Company, Los Angeles, California.

Boring, facing, and high speed drilling with one set-up cut the floor to floor time about one-third on this job.

The Kelman Electric & Mfg. Company say their Cincinnati Super Service Radial Drill "handles easily, is very accurate and versatile."

They are facing 6" diameters; drilling for ½" bottom tap, and tapping with a ½" bottom tap on this job.

The part being processed is a Bronze Top Casting.

Cincinnati Super Service Radial Drills are profit makers in this shop, and they could be in yours.

Write for Bulletin R-21C

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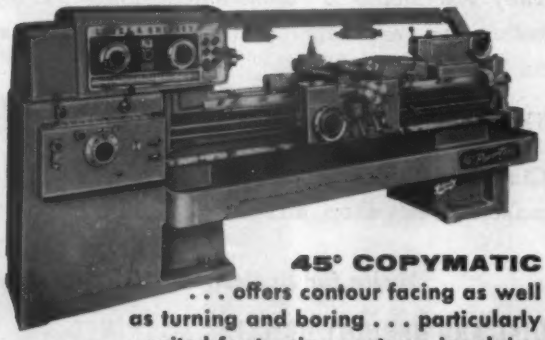
There are 5 new sizes and types of COPYMATICS suitable for your needs. Complete details are available in two new pieces of literature: Bulletin 309, 90° COPYMATIC and Bulletin 310, 45° COPYMATIC. For your copies, address: The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.



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. . . offers contour facing as well as turning and boring . . . particularly suited for turning contours involving diameters connected to faces by curves!

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. . . traces in both directions: toward head or tail . . . faces exactly square shoulders . . . maximum versatility and tracing capacity!

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No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

No. 3-36

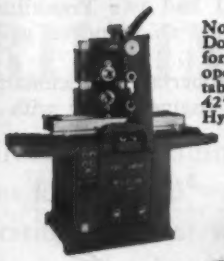
HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

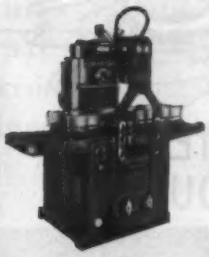
Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient



No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

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AUTOMATIC LATHES
and TURNING MACHINES
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OLIVER
20" TEMPLATE (controlled)
TOOL BIT GRINDER

The instant you equip your toolroom with an efficient Oliver, grinding time will be sharply reduced . . . production immediately expedited.

The Oliver method of single point tool sharpening utilizes a controlled and numbered template . . . grinds the complete tool in a single operation on one machine. The simple-to-operate 20" Template Tool Bit Grinding machine grinds single point tools in a fraction of the time required by other methods . . . reduces grinding time on tough tungsten-carbide work as much as 100% to 500% (using a notched wheel, with water on the wheel and through the wheel, makes this possible). Where quantities of precision-ground duplicates are required, the Oliver Way is the BEST!

Single point cutting tools machine ground on an OLIVER TOOL BIT GRINDER provide lasting accuracy *essential* to the efficient operation of automatic lathes and turning machines. Ground on an Oliver, single point tools have a fine finish . . . meet top standards without requiring the usual second operation of diamond-grinding. An OLIVER 20" TEMPLATE TOOL BIT GRINDER is a small investment for your toolroom that is sure to pay large dividends.

We'll be glad to tell you more—just write, wire or phone.

OLIVER INSTRUMENT CO.
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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Aluminum Cylinders

The letter of Robert Beardsley (*AM*—Oct 10 '55, p109) interests me. I not only recall the Pierce-Arrow headlights in the fender, but its cast aluminum body, which was a problem for the painters. I drove one in 1930 belonging to my son. I also recall the first Pierce cars in the first Auto Show in Madison Square Garden. It was a small runabout about the size of the old Autocar.

I wonder if Mr Beardsley's recollection is correct regarding the aluminum engines. I remember the cars very well, having seen them in the plant shortly before they were shipped to England. Twelve of them were built for a British engineer by the name of Pomeroy who tried to push the use of aluminum in the auto industry. They were nearly ready for shipment when I saw them, but I thought they told me that only the axles, frames and bodies were of aluminum. The bodies were about a half-inch thick and were, I believe, the only ones of their kind. The axles were of I section and, of course, of much larger cross-section than the steel axles used at the time, as this was a heavy car. While there would have been a great saving in weight by the use of aluminum cylinder blocks, I think I would remember such an innovation.

The first aluminum cylinders I ever saw were in Cleveland during World War I in the laboratory of the Aluminum Co. They were experimental, and were made for the Franklin car, which always stressed lightness. The idea was to plate the cylinder bores with cast iron. In case of wear the cylinder was to be replated. As Franklin never put these motors on the market, I assume the experiment was not a success. Franklin did however pioneer in the use of aluminum pistons and was, I think, the only builder to use forged aluminum connecting rods to reduce reciprocating weight. I had two Franklins with these rods which never gave any trouble.

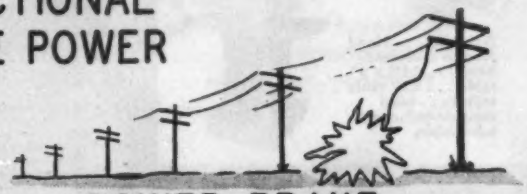
E W Roberts, of Cincinnati, built the first engines I saw with alumi-

GRINETICS

By D G SMITH

FRACTIONAL HORSE POWER

SEPTEMBER MOURN



POWER BRAKE

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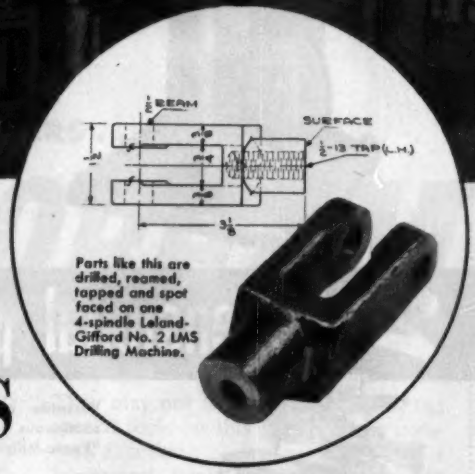
PNEUMATIC SCALE *Keeps Cost and Quality in Balance*



Parts like this are drilled, reamed, tapped and spot faced on one 4-spindle Leland-Gifford No. 2 LMS Drilling Machine.

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The complete line of Leland-Gifford Drilling Machines offers you a wide choice of machine sizes, number of spindles, swings and types of feed. All feature time-saving centralized controls and built-in safeguards against costly errors.

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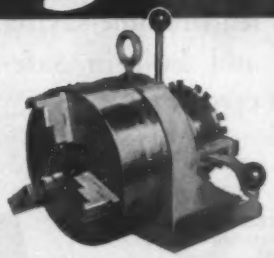
3-WAY Indexing Trunnion



Simple, Rapid, Positive positioning of workpiece or jig for all angle Drilling, Tapping, or Counterboring. Available with Chuck, Faceplate, or Right-Angle Adaptor Plate. Complete with Station Selector. For details, ask for Bulletin IT3.

J&B EST. 1870

JOHNSON & BASSETT, INC.

PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

num cylinders. I am not sure of the kind of piston he used. They were small motors for the types of planes used during World War I and he stopped building them about 1919. I do not think they were very successful. Incidentally Roberts had worked with Hiram Maxim in England in building the huge multiplane designed to test the lifting power of wings. This was prior to 1894 when the machine came to grief because the wings lifted so much more than Maxim had anticipated. It was never intended to fly. It was a multiplaned affair with wings over 100 ft span and weighed over 8000 lb. The engine was a marvel of design and construction that delivered power with remarkably low weight. I also knew Colonel Cowan, then editor of *Engineering*, London, who had also worked on Maxim's machine and had been on some of the trial runs. It ran on a track with guard rails to prevent its lifting too far off the track. On the final run the lift was so great that the guard rails broke and the machine was wrecked. Had the experiments been continued, we might have had mechanical flight several years sooner than we did.

The only other engine with aluminum cylinders I recall was the 16-cylinder Marmon built soon after the first World War. The cylinders had steel liners which, as I recall, gave some trouble because of the difference in the rate of expansion between steel and aluminum. At the same time I saw an interesting experiment in the use of diamond cutting tools. The main bearing caps fitted into recesses in the crankcase and the fit was held to close limits. For finishing the ends of these caps they used a special fork-shaped toolholder with diamond cutting tools. These were spaced the correct distance apart and the work was done in a shaper. This was, of course, for the finishing cut only. It is the only case where I saw diamonds used as a cutting tool in a shaper. They also told me that they had used a diamond tool in finishing the cylinder bores. As the Marmon Co did not continue in the automobile business long after this, I assume the use of diamond tools in this way was discontinued.

Fred H Colvin
Point Pleasant, N J

Paging Winsted

You must have heard about the recent serious floods which we faced a few days back. This flood has

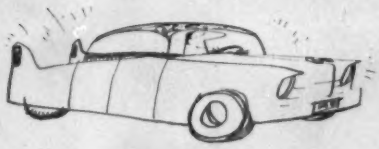
ruined many people altogether. In my case I have suffered a very very big loss. My oil godowns have been washed away, my other godowns of machinery spares and Artsilkyarn have also washed and fell down. Three of my houses are now debris. My family's clothings, household effects, quilts etc etc all have been washed away and I am facing much troubles. I know that America always come forward to help at such occasions but since such helps come in a combined way it is impossible for us to even think of getting any share.

It is therefore requested that all the machinery and oils dealers may kindly be approached on my behalf and they may be requested to come forward to help me immediately, so that an old businessman may be able to stand again on his foots, and for this act of kidness, I shall be ever grateful to you.

The aid so collected may kindly be sent direct to me.

Thanking you very much and waiting for your benevolent helps.

S M Uzair
Lahore, Pakistan



Gold Cadillacs

I have read with much interest the article on high-modulus tool shanks (*AM*—Oct 10 '55, p144). However, I detect one serious flaw in it—the matter of coat. I appreciate that Mr. Kennicott is interested in selling as much carbide as possible, but it is a bit like a goldsmith raving about the beauty of a solid gold Cadillac. Of course it would be gorgeous, but who in thunder could afford it?

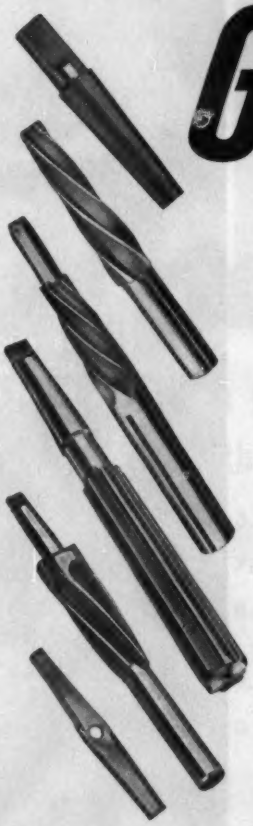
We'll buy little carbide tips in spite of their price because we know they will more than pay their way, but when it comes to spending hundreds, perhaps thousands, of dollars for solid carbide shanks, it would be much cheaper to put up with the chatter marks on the lathe and remove them by grinding at a second operation.

Now that Mr. Kennicott has proved his point, why does he not come up with a practical suggestion? If solid carbide shanks would be perfect, what is the next best thing at a price we can afford?

George Moehler
Racine

FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham **TOOL COMPANY**

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

NEWS OF TWO GREAT NEW

16" and 18" sizes . . . bench, floor and multi-spindle—power feed on larger sizes

Look at these handsome new drills and you'd guess they cost twice their modest price. Run them all day on production jobs and you'd say they're worth it. These are real machine tools, yet they're priced to a home workshop budget.

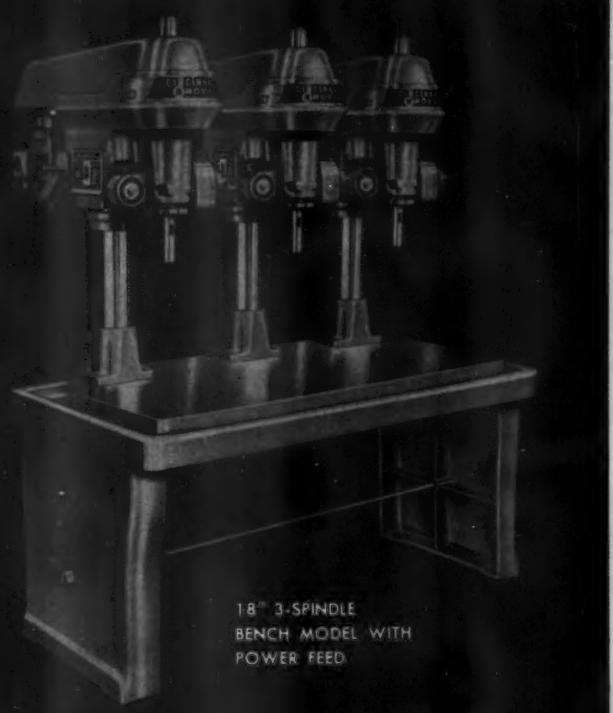
What does this mean to a machine shop, a maintenance shop or a school? It means that no job need go begging for modern equipment. No operator need sacrifice the safety and convenience of a full belt guard and built-in electrical controls. No production line need be slowed by old-fashioned drills. Not when clean, modern machine tools can be bought for prices like these.

New catalogs and specification sheets are ready on the 16" Royals. Write for them and the name of your nearest Cincinnati dealer. Cincinnati Lathe and Tool Co., 3251 Disney, Cincinnati 9, Ohio.

18" SINGLE-SPINDLE FLOOR MODEL WITH POWER FEED

CINCINNATI LATHE AND TOOL CO.

DRILLS FROM CINCINNATI



18" 3-SPINDLE
BENCH MODEL WITH
POWER FEED

16" SINGLE-SPINDLE
BENCH MODEL

Shop for a drill with all these built-in features supplied as standard equipment, then compare prices with the NEW ROYALS

1. Power feed at slight extra cost on 18" models.
2. Shipped complete with built-in electrical controls. Merely mount motor, connect leads and start drilling.
3. Direct-drive through simple V-belt transmits power to 6-splined spindle.
4. Easy speed change — raise guard, tilt motor, shift belt.
5. Full-floating spindle mounted in four precision, lifetime lubricated bearings.
6. Five spindle speeds on 16"; six on 18" drills.
7. Quick-set depth dial and positive stop.
8. Heavy column of ground tubular steel; castings of close-grained iron.
9. *Machined* working surfaces.
10. Built to definite standards of accuracy and tested before shipment.

POWERED FOR PRODUCTIVITY

. . . the all new

KING

greater horsepower — expanded speed and feed ranges — permit use of modern cutting tools to their fullest capabilities.

Completely re-designed King Vertical Boring & Turning Machines bring to boring mill users the greatest productive capacity ever achieved for vertical boring and turning work.

Horsepower has been increased to 10 to 20 H. P. on 30" to 40" machine sizes; 25 to 100 H. P. on sizes 46" and up. Spindle drive provides 24 speeds in each of high, intermediate, and low ranges. As shown in illustration at lower right, the complete drive transmission is mounted in an extra-rugged housing, providing greatly increased stability. The entire drive can be removed from the machine as a unit.

24 feeds from .0016" to .500" per revolution are provided. The exact feed can be selected to produce the desired surface finish on any material at the required production rate.

Complete electrical controls are provided, located on pendant station and on feed panel mounted on side head, for maximum ease and speed of manipulation.

With many other features, the all new King provides industry with a high-efficiency machine tool capable of taking full advantage of new cutting tools, new materials, new methods. For full details, send for new Catalog K-5. Write direct or to the King distributor in your area.

Additional Features of the ALL NEW KING

- NEW SPINDLE AND SPINDLE MOUNTING, PROVIDING MAXIMUM TABLE STABILITY.
- AUTOMATIC LUBRICATION OF ALL MOVING PARTS.
- ANTI-BACKLASH NUTS FOR ALL CROSS-FEED MOVEMENTS.
- MACHINE ADAPTED FOR SIMPLE OPTIONAL ADDITION OF:

Automatic positioning of heads.
Automatic tracing control of heads.
Automatic cycling.
Power rail clamping.
Power indexing of turrets.

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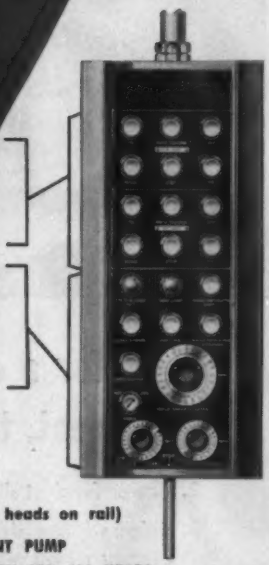
KING VERTICAL BORING & TURNING MACHINES

NEW 46" KING VERTICAL BORING & TURNING MACHINE with Turret, Ram, Side Head, and Coolant Pan

WIDE VARIETY OF HEAD COMBINATIONS AVAILABLE



...with
...S
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FEEDS
DIALS
...EX • TABLE STOP
...ad has controls for:
... DIRECT-READING DIAL
...AVERSE MOVEMENTS
(on machines with two heads on rail)
...RAIL POSITIONING • COOLANT PUMP
...G & TAPER TURNING SELECTION FOR ALL HEADS

Spindle Drive Transmission

Re-designed throughout. EXTRA-RUGGED HOUSING provides increased stability and rigidity for mounting of shafts.

Short shafts used throughout with points of load located adjacent to bearing supports.

Spot News of Metalworking . . .

- **Investment cast turbine blades cost too darned much.** That's what Ford metallurgist Donald Frey told a surprised meeting of the Investment Casting Institute in Detroit recently. His ultimatum: "If you can't get the cost per blade down to 15¢ over metal . . . perhaps shell molding is the answer."

- **Politicians and the public couldn't be less interested in automation.** Proof: Chairman Wright Patman (D, Texas) was the only subcommittee member to turn up for the recent Congressional hearings on automation. And the press table held more people than the public pews. (See "Field Report USA" p175).

- **Air Force's giant 50,000-ton forging press is in production** at Wyman-Gordon Co's North Grafton, Mass, plant. Its first job: aluminum landing gear support ribs for Super-Constellations.

What about that 15-20% bidding edge supposedly given would-be government subcontractors in U S designated "labor surplus areas"? One such firm was told by a Small Business Administration representative, in effect, "don't kid yourself — the lowest bidder gets the contract, no matter where he is."

- **Ford is buying huge numbers of machine tools for its engine programs** at its new Lima, Ohio, plant, for the Rouge works, and for its Cleveland Plant. Many of the orders are for delivery in first half of 1957.

- **Air Force would like to buy long lead-time machine tools** and put them to work on current production to reduce cost of new planes, rather than keep them as standby equipment. If the reserve program for $84 million, recently cancelled, is not converted to this idea, the Air Force may find funds elsewhere to carry through with these purchases.

- **Tape-controlled wing skin-millers are being tested for the Air Force.** Test setup is reported performing operations in 12-14 hours that previously required 400-600 hours. It's said to be a short-run setup wherein the machine does all operations in one position, rather than moving through a sequence.

- **Germany's Focke-Wulf aircraft plant is back in business.** It's making light, 140-hp single-engine four seaters for private use. The BL 502 has a top speed of 135 mph, and a range of 625 miles.

The rift is getting bigger in labor's ranks between the skilled and unskilled. Recently, 400 UAW-CIO skilled craftsmen applied to NLRB for independent union status as the Society of Skilled Trades. The Society, already organized in Flint and Detroit, claims 40,000 card-carrying members. UAW-CIO is reported to have ousted anybody who signed with the Society. (See p177).

- **All Navy capital ships will be nuclear-powered by 1960,** Rear Admiral H G Rickover, "father of the atom sub," has predicted.

- **Up for auction in the next 30 days or so:** The $15-million Wilson Foundry & Machine Division of Willys at Pontiac, Mich; Studebaker-Packard's $3.5-million forging and foundry plant in Detroit; Murray Corp of America's $7.5-million auto stamping plant in Detroit; and Thor Corp's Meadows Division appliance plant at Bloomington, Ill, value $750,000.

Modernize Today for Profits Tomorrow

WITH FAST, VERSATILE PRECISION WAY MACHINES

EX-CELL-O TWO-WAY: Operates from a single push-button station. Handles large, heavy work. Fixture section can be designed to accommodate the way units from any angle.

Units may be re-arranged around fixture or new fixture sections designed for different operations.

EX-CELL-O ONE-WAY: A standard way unit combined with a fixture unit to suit the work. Large, heavy, and awkward parts, loaded in the fixture, remain stationary; the spindles advance to the work.

EX-CELL-O THREE-WAY: Standard way units are electrically interlocked to operate simultaneously, or in any sequence. Fast and efficient for machining parts from three directions and holding accurate locations.

EX-CELL-O FOUR-WAY: Controlled from a central push-button station. Particularly suitable for machining parts from four directions simultaneously, and performing progressive operations.

EX-CELL-O

WAY TYPE PRECISION BORING MACHINES ARE PROFIT INSURANCE

Way Machines perform such operations as precision boring, turning and facing. They consist of one or more standard way units combined with a fixture section. Each way unit has its own hydraulic system and controls to operate the spindle slide. Tooling and fixture are added to suit the individual operation. Get details from your Ex-Cell-O representative or write for Way Machine Catalog.

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CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

XLO
EX-CELL-O for PRECISION

55-50

Washington . . .

Iron Curtain trade . . .

Commerce Dept will open 1956 by announcing additions to the list of goods that can be exported under general license to the Soviet Union and its European satellites.

Best bet now is that the additions will include agricultural machinery, food-processing machinery, light construction machinery, light electrical equipment, tools for light industry, etc. At present, individual export license must be obtained for each shipment of such goods going through Europe's Iron Curtain.

Effect of the impending relaxation will be to make it easier for the Soviet bloc to get these goods—if it wants them. Government officials doubt that a sizeable market exists. The goods have been fairly freely available under individual license for more than a year now, and firm offers to buy have been extremely light.

Important to remember: things that the Russians apparently are really interested in buying from the West—heavy capital plant machinery and equipment —will stay on the strategic list, meaning that they can't be exported to Russia or her satellites.

New automation study . . .

Newly-published federal studies on post-war advances in productivity and automation won't tone down the controversy despite the answers turned up. The gist of the U S Labor Department reports is that the effects of both developments are moderate as far as the displacement of workers by machines and the increase in factory output per manhour are concerned.

Even the Department emphasizes that the surveys may be off base because of the technical difficulties of assessing the effects on industry. They vary sharply between industries and even between firms in the same industry. But, because of the explosive nature of both subjects, they'll be the object of support, or attack, by both labor and management groups.

Labor unions, which center their collective bargaining demands on the increase in worker output, object that the productivity figures are too low.

The Labor Department puts the average yearly advance from 1947 to 1953 at anywhere from 3.1 to 3.6%, depending on which of four studies is used. The unions claim the jump has been much higher, particularly in the last two years.

The reports on use of new automated equipment in two companies—an insurance firm and a radio and TV manufacturing company—disclose little effect on employees. Where machines displaced workers, the workers were assigned new jobs. In many cases these were jobs created by the machines. But these were only two cases and the results won't parallel those of other firms.

Despite the apparent moderate effects, the Labor Dept recognizes possible future disruptions—and is going ahead with more research. New studies are in the works on how to help the older work, minority groups, the chronically unemployed—in the face of changing industrial methods.

But the department won't reveal all. Recognizing that it's a touchy subject—that may provide an inaccurate background for barganing — the government is holding on to its figures breaking down the advance in productivity by individual industries. There's just too much variance to show average advances with an industry that could be used as a yardstick for bargaining.

Politically, automation will not be a very explosive issue — not in the short-to-middle-run, at least. Political heat dropped many degrees after New Dealing Rep Wright Patman of Texas conducted a brief investigation, studying whether problems were present that required Washington to get into the act.

The answer, which Patman added up for himself, is no. He says he will not recommend legislation to control or slow down the trend because industry appears to be accepting responsibility for re-training and re-assigning displaced workers. Patman says, however, he intends to keep watching the situation.

Buy American has a "New Look" . . .

U S electrical equipment industry gets a break in competition with foreign suppliers under a new formula applied to the Buy American Act.

Electrical equipment makers in areas of high unemployment will get, under the new formula, a 15% preferential advantage in price over foreign suppliers. The edge to domestic manufacturers now is only 6%.

It's not clear yet whether all industry will get the same price edge over foreign competition for federal procurement business. That question is still being kicked around in Washington.

Titanium lead-time . . .

A 90-day lead-time specification between titanium production and fabrication has been proposed by Commerce Dept's industry advisers.

Government officials, simultaneously, asserted belief that an open expansion goal for titanium sponge is no longer needed. Industry people take a dim view of foreign titanium purchases, which come primarily from Japan.

They told Commerce officials that if the government plans to keep buying foreign-produced titanium, domestic industry should be advised of plans far enough in advance to make allowances in their own plans.

MICROHONING* . . . FACTS YOU SHOULD KNOW

Compare These Microhoning Advantages

- Rapid and efficient stock removal.
- Dimensional accuracy obtained in every part.
- Macrogeometric accuracy—the Microhoning action is not affected by vibration; long abrasive stones generate a true surface.
- Microgeometric accuracy—any desired surface finish and cross-hatch angle duplicated in every part.
- No concentration of heat—the structural surface of the part is undamaged.
- Microhoning applications include tapers, spheres, splines, tandem or interrupted bores, flat surfaces, and any type of material, regardless of hardness (or softness).
- No practical limitation on part length and diameter.
- No chip removal problem—the minute Microhoning chips are flushed away in the coolant and automatically removed.
- Automatic size control.
- Readily adapted to automation.
- Eliminates tool dressing time and cost.
- Location of bores is undisturbed.
- Float principle and low speeds assure minimum maintenance.
- Backed by over 26 years of engineering and service experience.

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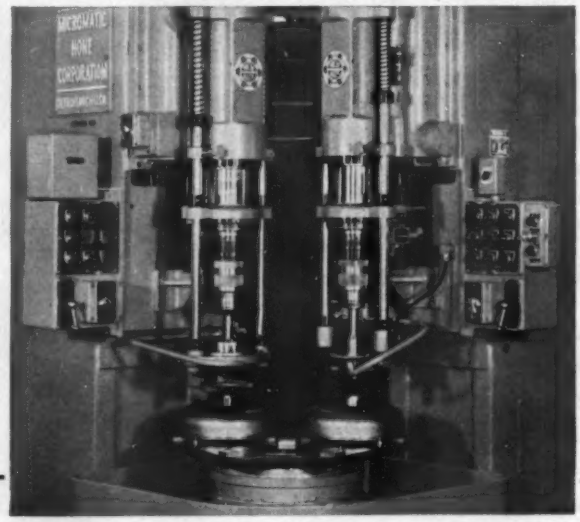
Microhoning is a low-velocity abrading process that employs thousands of small cutting tips. Because simultaneous and continuous cutting action of tips is spread over a wide area, stock is rapidly removed with a minimum of heating. This abrading technique generates functional surfaces ***by obtaining in one operation the required tolerances, specifications,*** or ***condition*** of the surface characteristics.

Included in these characteristics are: dimensional size (the distance between points or faces of a part, e.g., the diameter of a bore); macrogeometry (waves whose crests are more than 1/32" apart); microgeometry (roughness or scratches whose crests are less than 1/32" apart); and surface structure.



Microhoning . . . Example Application

Microhoning both I.D. and O.D. of the hub of a transmission torus cover to generate geometric accuracy and a surface finish of 10 microinches.

O.D.—*2.375", approx. 1" long, blind end*
I.D. —*2.125" x .280" long*
58-60 Rockwell "C"
Stock removal: *.001" to .002"*
Surface finish: *10 microinches*
Production: *180 per hour, gross.*

***MICROHONING = Stock Removal + Geometry + Size Control + Surface Finish**

Movies describing various machining processes and the generation of functional surfaces are available for group meetings. For literature or further information on films, write to:

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Detroit . . .

Ultimatum . . .

"Turbine blades are now exorbitantly expensive . . . they must come down to a cost to the buyer of 15¢-over-metal-cost per blade . . . if you can't do it in the investment casting industry . . . perhaps shell molding is the answer."

Those are the take-it-or-leave-it words of Donald L Frey, associate director of Ford's Scientific Laboratory's Metallurgical Dept, that figuratively knocked members off their chairs at the Investment Casting Institute's technical session here.

He added that the gas turbine is the "engine of the very near future," implying that the investment casters won't play much part in that future if they don't get their prices down. The industry, in his own words, is "too expensive."

Unit construction of auto bodies . . .

. . . is near. That's the prophecy of American Motors, which says "all other manufacturers will sooner or later adopt our method of unit construction," and it looks like that forecast is at the stage where it's bearing fruit.

At least two other auto companies—major ones—have privately endorsed AMC's statement, but they say the changeover from present chassis construction will be a gradual one because of the considerable changeover in tooling and machine work. The thing to look for, according to these sources, is a gradual creeping-around of frame steel at the engine compartment, a la Nash.

Crystal ball exercise . . .

When an independent in the automobile business steals a stride on the Big Three, you can make book that they will retaliate with a vengeance.

American Motors, a vigorous independent, has stolen a big stride on the other people by producing what it calls "the first air conditioning system completely integrated into the basic design of the body."

AMC's Nash Rambler, which will appear formally in December, boasts such a system. And AMC is backing up its work with the statement that air conditioning will be as common on automobiles as automatic transmissions within the next three years.

One design engineer (of a rival company) said: "Sure, they did it to us. But we'll be there in '58 at the latest, maybe even '57. And ours will be better."

Big '57 tooling for Olds?

Oldsmobile engineers are notoriously cagey about talking about upcoming expenditures. Under a little pressure and a lot of pushing last week they did admit that expenditures for tooling and machining will be up for 1957 . . . up considerably.

Oldsmobile will produce 625,000 cars in the calendar year of 1955—by dint of third-shift work and plenty of overtime in a plant geared to produce a two-shift total of about 583,000 units.

With defense orders plummeting downward and soon to cease, Oldsmobile is putting defense plant space to work in automobile production. By using a third shift — and the inevitable overtime — Olds people say they can hit their target of 750,000 units for 1956.

Will 1956 be the "off year"?

Auto manufacturers talk, privately, about the very real possibility that there will be one "off year" between now and the promised land of unlimited production and prosperity that will begin in the 1960's.

Auto men might be pointing at 1956 as the year they are afraid of. With something like one out of every four "earning units" (families or individuals) making time payments on a car right now, it might follow that 1956 sales will be tough to push along at as fast a clip as 1955 sales rambled.

From over-the-transom-squints at drawing boards and mock-ups—1957's cars are scheduled to be right out of this world. Word is already leaking out that the 1957 models will be better, flossier, finer than anything ever offered before. Could be that the people that make the cars are arming themselves with merchandise to arrest and recapture a market that might be sliding a little.

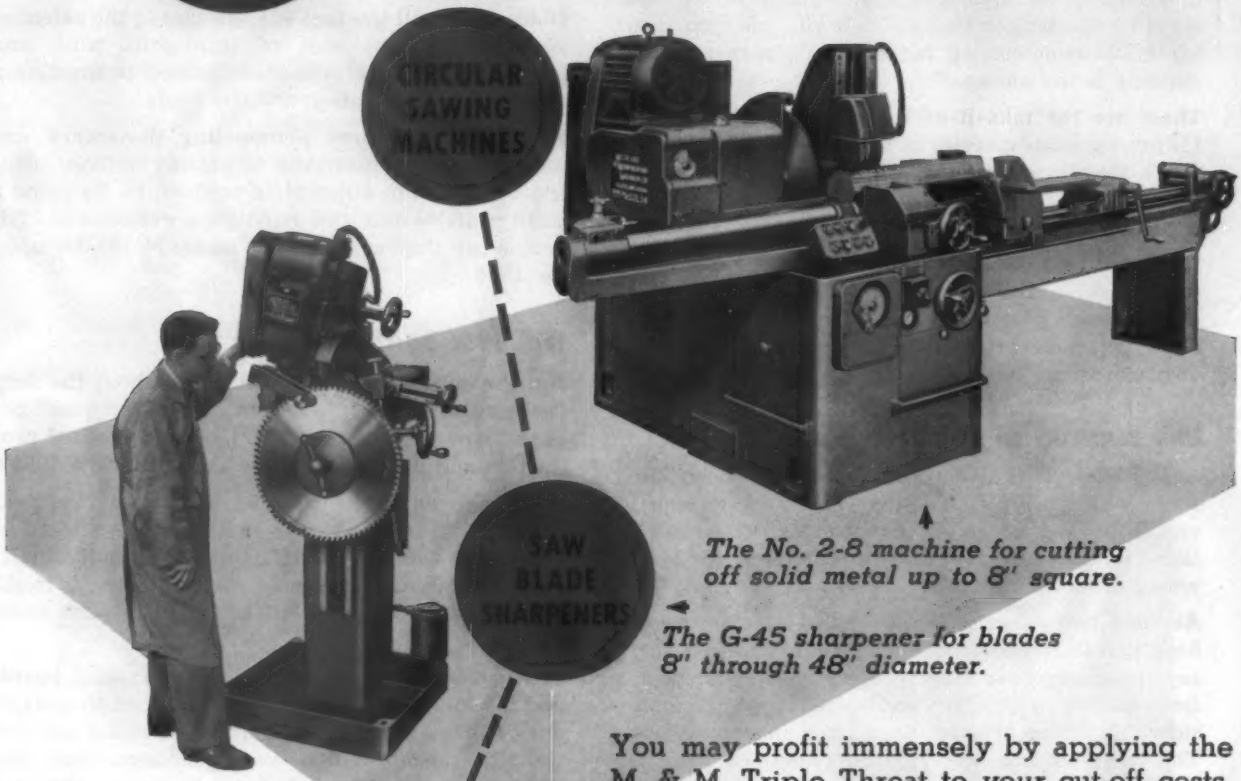
New trend in station wagons . . .

The Nash Rambler station wagon—a potent number that is going to make a lot of people begin wishing and then reaching for their time payment book—has a new feature that AMC's so proud of it couldn't wait until the car came out to tell everyone.

Most station wagons have a two-piece rear panel: one piece lifts up, one piece folds down to make a platform. Nash's Rambler for 1956 does it differently; the top half of the rear panel is glass and it rolls down into the bottom half—ergo—no top leaf to bat your head against, plus full air flow through the body on those hot days in the summertime.

Look for a big three-way battle for U S sports car supremacy. The entries: a revamped Chevvy Corvette (still plastic-bodied) with a more potent engine; Ford's gleaming 1956 Thunderbird with its continental touch and spare tire mounted aft of the trunk; and Studebaker's new Golden Hawk—a 120-hp bomb that could upset sports market applecart.

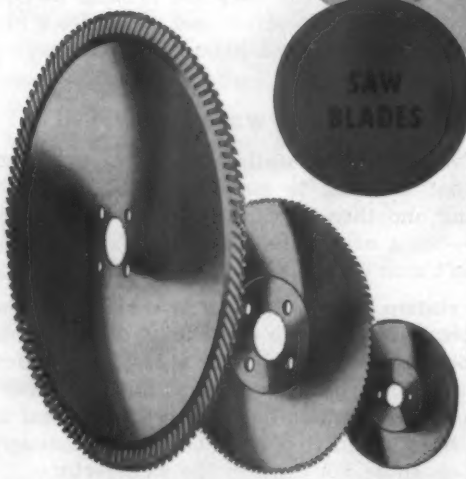
THE Triple-Chip METHOD IS A *Triple-threat* TO HIGH CUTTING COSTS



The No. 2-8 machine for cutting off solid metal up to 8" square.

The G-45 sharpener for blades 8" through 48" diameter.

You may profit immensely by applying the M. & M. Triple Threat to *your* cut-off costs. Machine, blade, and grinder, made by the first company to build all 3, often effect phenomenal savings, as proved by detailed case studies. *Just such a study of your job is yours for the asking.* We offer you an unmatched experience in the sawing of any machinable metal, round, square or structural shapes, from 1/4" through 43" diameter.



M. & M. saw blades cut any machinable metal. Cut-off blades: segmental — 11" through 120" diameter; solid — 8" through 20" diameter. Slitting saws — 3" through 8" diameter.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

Machine Tools . . .

Detroit is buying machine tools . . .

Automotive demand for machine tools is at a high point and is likely to stay there.

Much of it is for special automated production lines. It also is for standard high-production machines for special jobs.

Orders have been coming into builders from Detroit for deliveries that extend well into 1957. This tooling is principally for new engines that car makers hope to have ready for 1958 models in the fall of '57.

Many of the orders, however, are for delivery by the middle of next year. They are for tooling for 1957 models to be introduced in September or October of 1956.

Ford has biggest program of all . . .

Ford apparently has the biggest tooling program of all at the moment.

It is buying machine tools for its new engine plant at Lima, Ohio, for the engine plant at Rouge, and for Cleveland.

Some of the machines already have been placed, but a large part of them are yet to be purchased.

A brand-new engine is reported to be involved in this tooling program.

The Ford program is so huge that it will take up a good portion of the capacity of many special machinery builders for months ahead.

Chevrolet placing orders for Toledo . . .

Chevrolet recently has been in the market for machine tools for its new transmission plant at Toledo. This is a sizable tooling project which Chevrolet hopes to push to completion by the late spring or early summer of next year.

These early delivery dates alone have excluded at least a few special machinery builders from participating in the Chevrolet business, because these builders are loaded with work and could not meet Chevrolet's deadline.

A certain amount of Buick machine tool business has been popping too.

Plymouth to add a third production line . . .

Plymouth still is planning on adding a third line to its two engine production lines for its V-8 motor. Reports are that the third line, possibly to be housed in Plymouth's old engine plant in Detroit, will be a duplicate of the existing lines.

The machine tool industry's orders for metal-cutting machines in the first nine months of 1955 surpassed those booked in all of 1954.

They were more than $100 million ahead of shipments in the January-September period of this year.

New orders for the entire year, provided that the pace established earlier is maintained, should be around $775-$800 million. This total is believed to be well within reasonable limits.

Shipments, on the other hand, are not likely to go above $675 million.

One of the main reasons why production has lagged is the difficulty of getting into building new major lines of machines displayed at the Chicago Show.

Builders have been swamped with inquiries as a result of the Show. Seldom if ever in the history of the industry, barring World War II and the early Korean period, have there been so many inquiries.

Air Force wants reserve machines put to work . . .

Conversations are in progress at Wright Field and at Washington that lead to the conclusion that the reserve machine tool program of the Defense Department is not dead. It is merely dormant.

The Air Force has the biggest stake in the program. It had $84 million involved in the first $100 million and probably would get as much as $30 million out of the second $100 million.

What the Air Force big brass would like, according to well-informed sources, is to place orders for the reserve machines and then put them to work in plane plants on current production work. This would result in impressive savings in manufacturing costs.

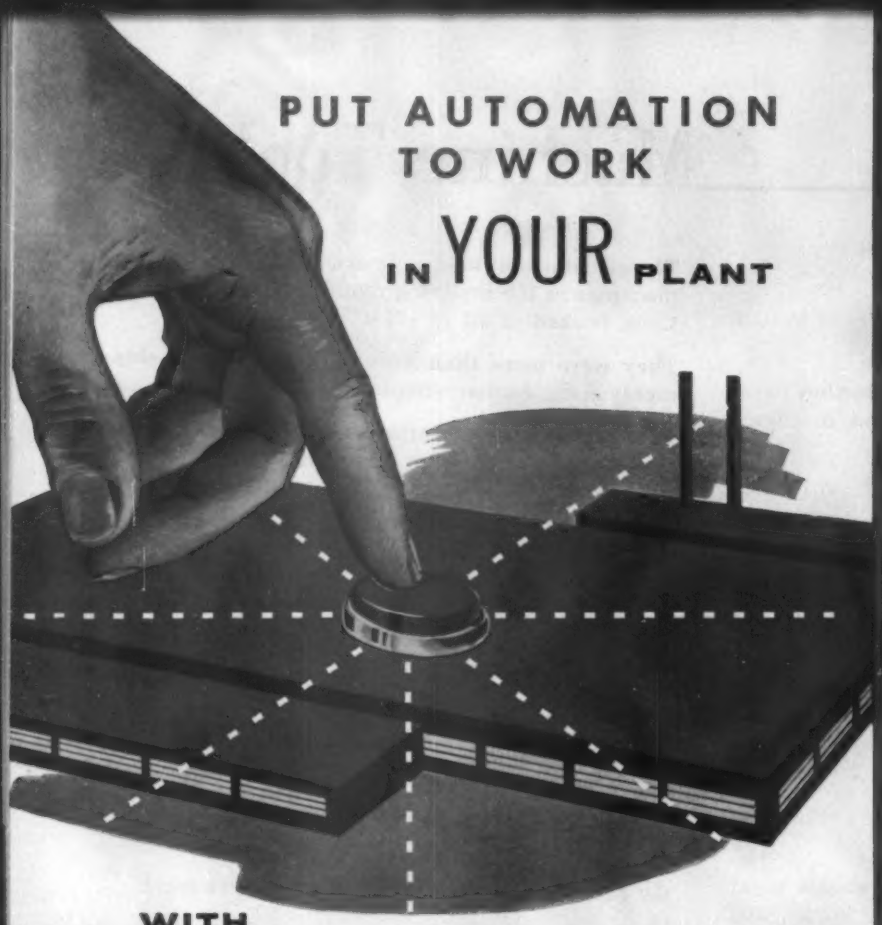
Congress would have to consent, however, to this change in purpose. The $200 million already voted is specifically for machines for standby and not for installation in plane factories.

It has been suggested that Secretary Wilson could bring about this change if he would appear before the Joint Congressional Committee on Defense Production and explain the situation. A vote of the Congress probably would not be necessary.

It is even possible that if the obstacles to a go-ahead with the reserve program are insurmountable, the Air Force might be able to find enough money in other spots to carry through with its idea.

BF

PUT AUTOMATION TO WORK IN YOUR PLANT



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(Advertisement)

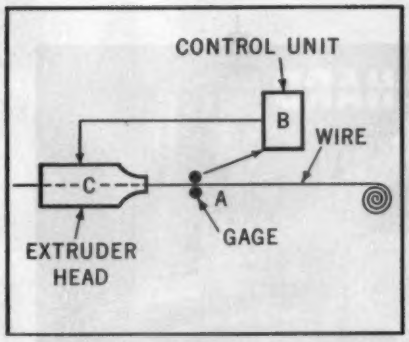
AUTOMATIC Process Control

Automatic Process Control is one of the principal facets of automation . . . and also one of the oldest. Nearly twenty years ago, Pratt & Whitney successfully engineered controls that provide completely automatic classifying and sorting of tin plate on shearing lines. Sometimes referred to as the "feedback" or "closed loop" system, automatic process control is concerned with measurement of thickness, size, quality, finish of the product during some point in the production process . . . and translation of this data into a corrective impulse to the machine. Benefits that may be expected from a successful installation are: much faster production, improved accuracy or quality control, and important savings through conservation of material and reduced spoilage losses.

The above description may make automatic process control sound more complicated in concept than it really is. While individual applications often involve difficult technical problems that must be worked out, the general set-up is readily understood. The Pratt & Whitney system used to control the diameter of covered wire as it is produced on extruding machines will serve as a representative example.

As shown on the accompanying diagram, diameter of the coated wire as it passes from the machine is checked continuously and automatically by a P&W Continuous Gage (A). Impulses from the gage are transmitted to the P&W Control Unit (B). (In addition to its function in the automatic control circuit, this unit also provides the machine operator with a continuous, diameter reading.) As the transmitted impulses indicate that the coating diameter is approaching the high or low limit, the control unit reacts to operate the size adjustment mechanism (C) of the extruding machine for a pre-set period. Adjustment then stops for the period required for the correction to reach the gage. If necessary, this cycle is repeated until the diameter is brought back to the required size. Provision is usually made for signalling the operator or shutting down the machine automatically should a situation occur that is beyond the control of the automatic system.

Installations of this type have been in operation for nearly ten years and have produced very important benefits. Since coating thicknesses are dependably held to the minimum required by established electrical standards, large savings in expensive coating materials are realized. Rejects

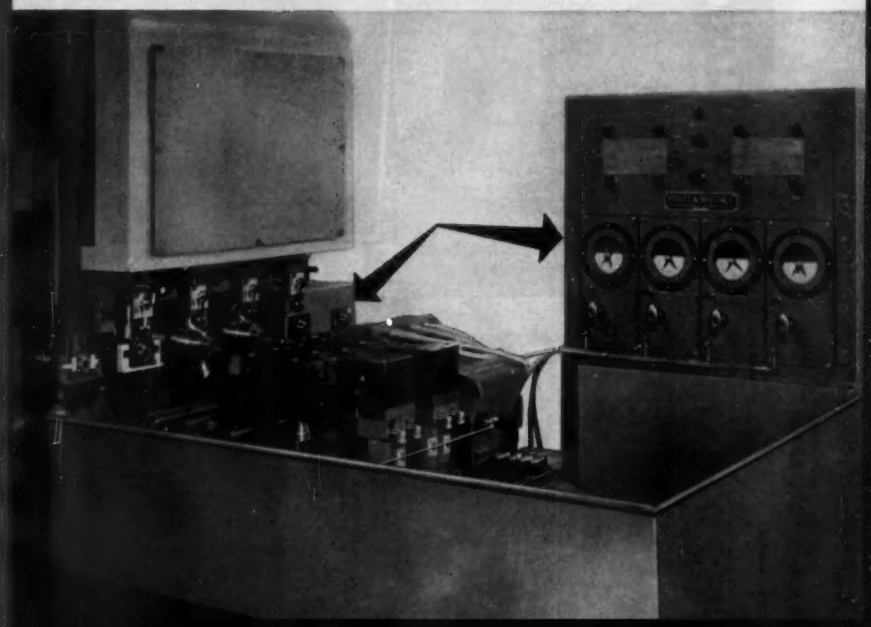


due to below-standard coating thicknesses have virtually been eliminated. Production rates have been substantially increased.

Basically similar P&W Automatic Control installations have also been applied to many other continuous production processes such as cold rolling mills, foil mills, calendering operations, sorting, classifying etc. More recently, P&W has been engaged in the successful application of automatic process control to a wide variety of machining and grinding operations. In a typical installation, individual workpieces are automatically gaged as they are machined. As off tolerance limits are approached, gage impulses are "fed back" to the machine via a suitable control unit – and are utilized to effect automatic re-setting of the cutting tools or the grinding wheel. Automatic sorting into acceptable, rectifiable and reject categories can be included, and automatic recording devices to provide a permanent record of the number of parts in each category are often incorporated into the control system. Benefits compare very favorably to those realized in continuous production installations: Overall production rates are increased since there is no need to stop production for adjustments. Control of quality and accuracy is greatly improved; reject losses are substantially reduced . . . often by as much as 40 to 50%.

As stated, Pratt & Whitney experience and engineering ability have made it possible to apply automatic process control successfully to a very wide variety of machining, grinding and other production processes. There are, of course, limiting factors . . . principally the adaptability of the older machines to adjustment through motor-driven means. The present day machine through an intensive program of research and development – has overcome this and other factors. It is reasonable to expect that automatic process control will very soon be a practical reality for virtually every major manufacturing operation . . . and forward-looking manufacturers who utilize this modern means of greater production efficiency will benefit accordingly.

HERE'S HOW
THE NEW BRITAIN MACHINE COMPANY
PUTS AUTOMATION GAGING TO WORK



Applied to a New Britain-Gridley Automatic Dual Boring Machine, Pratt & Whitney AUTOMATION GAGING provides in-process gaging plus "feed-back" control for automatic tool resetting.

The results: *Far greater accuracy* with a tolerance of .0003" constantly maintained in regular production. *Very high output* – machining internal and external diameters and facing at a rate of 120 pieces per hour – because down time for checking parts and adjusting the machine is eliminated. *Lower production costs* – thanks to *fully* automatic operation and fewer rejects.

You've *heard* about Automation . . . THIS IS IT . . . proved, practical and ready to go to work for you right now. So write West Hartford, outlining your production problems, and let P&W Automation Gaging Engineers help you produce more accurately, more profitably . . . automatically.

PRATT & WHITNEY COMPANY
INCORPORATED
11 Charter Oak Boulevard, West Hartford 1, Connecticut

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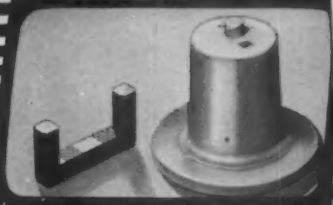
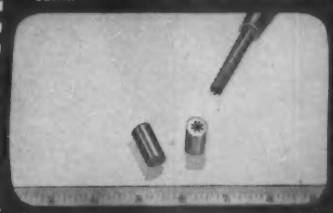
Nothing is too HARD to be Machined by

Sheffield's CAVITRON

Carbide blanking die and the Cavitron tool used to sink it.



Ferrite yoke slotted after sintering and glazed porcelain in which three round and one square cavities were sunk.



H.SS. lockwasher die blank, die and the tool which produced it.

H.SS. blanking die and tool.

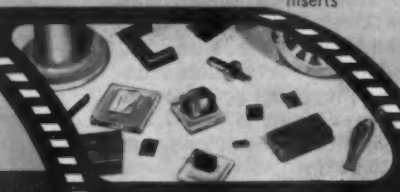
Carbide signet ring coining die with finished ring and Cavitron tool.

Cavitron is an ultrasonic tool by which even the hardest materials are machined readily, accurately and economically. And without regard for their electrical characteristics.

Because no heat is generated by the machining process no change is produced in physical properties of the material machined.

Cavitron is designed and built by the Sheffield Corporation which has been manufacturing precision tools for 50 years. In Cavitron you get the accuracy, rigidity and ease of control characteristic of the highest American Standards.

MACHINABLE MATERIALS	MACHINING OPERATIONS	PRODUCTS PRODUCED
Hardened tool steel	Drilling—boring	Dies, steel and carbide
Cemented carbides	Contouring—Engraving	Machine and motor elements
Ferrite—Germanium	Slicing and dicing	Electrical and electronic components
Cermets—ceramics—glass	Tapping	Jewell bearings—tools
Aluminum oxide		Tire molds—carbide inserts
Precious stones—quartz		

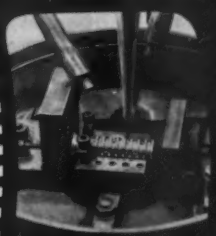


Group of parts machined by Cavitron.

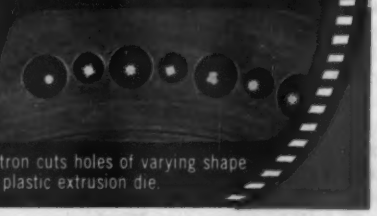
Have a Sheffield engineer show you in your own office the recent sound-slide film "Machining the Unmachinable." Here is Cavitron in operation. Write to Div. 810—*THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.*

7224

Group of Cavitron machines in assembly.



Sinking diamond shaped ports in a servo valve sleeve.



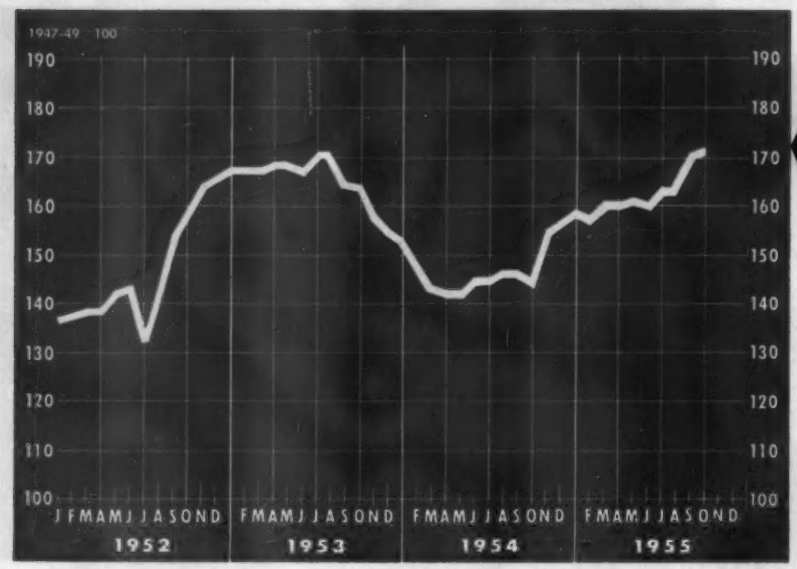
Cavitron cuts holes of varying shape in a plastic extrusion die.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURE AND MEASUREMENT FOR MANKIND

Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	OCT. Esti-mated	SEPT. Pre-liminary	AUG. Re-vised	SEPT. Year Ago
Total Index	**172**	**171**	**170**	**148**
Machinery	**138**	**139**	**125**	
Electrical Machinery	**211**	**205**	**190**	
Autos	**116**	**139**	**78**	
Other Transportation	**364**	**315**	**310**	
Other Metalworking	**143**	**141**	**124**	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Metalworking to stay at peak . . .

Now at a peacetime peak, the metalworking industries are expected to stay at or close to the present dizzy pace the remainder of the year.

What's more, the first quarter of 1956 looks great. And even beyond that, no letdown is in sight.

American Machinist's Production Index, at 172, is a point above the 1953 top when defense business gave a special zip to operations.

It is only 27 points below the all-time high of 199 reached in the midst of World War II (in November 1943 to be specific).

Boom demand for capital goods . . .

This burst of business has spread throughout all segments of Metalworking. Nowhere is it more spectacular than in capital goods.

Machinery production, in fact, has become the nation's largest manufacturing industry. And it promises to stay in that spot.

Backlogs of almost all machinery builders of all kinds are substantially greater today than at the beginning of the year. Production too has been increased, but not sufficiently yet to match the influx of orders.

Automotive industry is the pacesetter. Already scaling new production and sales peaks this year, in 1956 the industry will be looking for new worlds to conquer. Insiders have predicted sales figures for 1956 that would have seemed utterly fantastic just a few years back.

A lot of industries will be riding the bandwagon of autodom's prosperity, like the auto parts makers, who are booked to capacity 'way into next year, and see no sign of a letdown.

Along, too, for a high, wide and handsome ride are the stampings people, and the tool and die manufacturers, who have had some pretty tough sledding up and down business peaks and valleys in the last couple of years.

The tool and die men look for a banner year in 1956, mainly because of the extensive '57 model changes —part of the auto industry's new facelift every-two-years-instead-of-every-three years policy.

Drop forgers have a comfortable backlog, and with few exceptions, not a worry in the world these days. Backlog stands at about four months and steel bar stock is in good supply. One auto-industry supplier is running seven days a week and is badly in need of expanded capacity.

Steel casters are feeding high on the hog now that the railroads are back in the market with big new orders for equipment. Malleable and gray iron founders continue to do all right, too.

One industry not doing too well is aircraft parts manufacturing, where business is off maybe 20% from last year. But the plane parts people say '56 will make up for current doldrums.

Steel warehousing has a fast turnover . . .

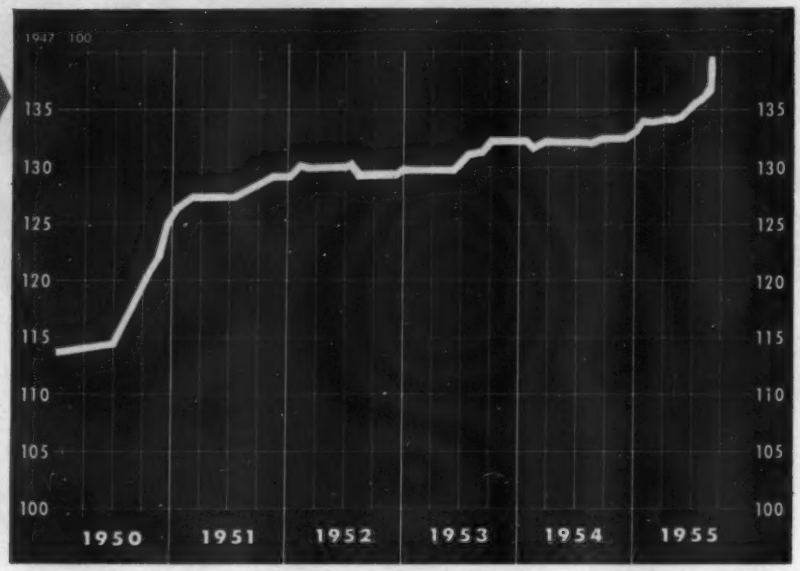
Currently, steel warehousers have a three months' inventory on hand—a four-times-a-year turnover that means big business.

Only fly in the ointment is the unbalance of items: the average warehouse is practically bare of structurals and plate, but it's loaded with a seven months' inventory of cold-rolled bars, and a five months' inventory of stainless. Sheet-coil supply is on a day-to-day basis, but you can get all the hot and cold-rolled pattern size sheets you want.

Gaging Business . . .

Price Index

	OCT. Estimated	SEPT. Preliminary	AUG. Revised	SEPT. Year Ago
Total Index	**139.0**	**138.3**	**137.1**	**132.8**
Metalworking Machinery	**156.9**	**156.7**	**142.4**	
Other Machinery exc. Electrical	**144.9**	**142.6**	**137.5**	
Electrical Machinery	**135.1**	**132.9**	**130.7**	
Fabricated Metal Products	**132.8**	**132.4**	**129.2**	



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

A new plateau . . .

"Superlatively good" is about the best way you can describe the business outlook. Business has been good, even excellent, for quite a spell but now it looks like it will reach unprecedented highs. Capital goods outlook is the indicator. McGraw-Hill's new survey of business's buying plans for new plant and equipment (p170-171) shows that business as a whole will up its capital spending 13% next year, and manufacturing companies will spend 30% more than they did this year.

Gross National Product is another bellwether. For the first time in history, it will edge up over the $400 billion mark to an expected $405 billion in 1956. This is an $18 billion gain over this year's figure.

If 1956 follows 1955's trend, each succeeding quarter's GNP will be greater than the last.

Even government spending will go up . . .

For the first time in several years, federal spending will increase in 1956. It will stay at 1955 levels generally, except for one thing: 1956 is an election year and there's a good chance that the farm vote will be influenced with a little judicial federal spending. But the real government spending lift will come in the state and local sectors, where agencies will spend about $42 billion more next year.

Consumer spending will jump in '56 . . .

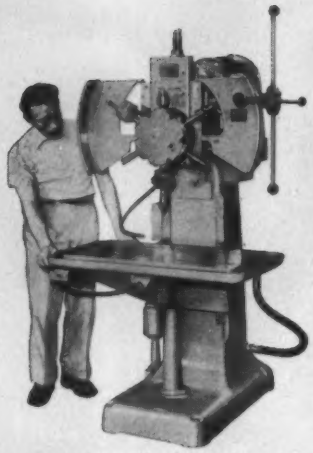
The public is expected to spend maybe $10 billion more next year, even though durable goods sales will be off slightly. Soft goods ($8 billion more) and services ($4 billion more) will compensate by gaining a bit.

Continuing trends . . .

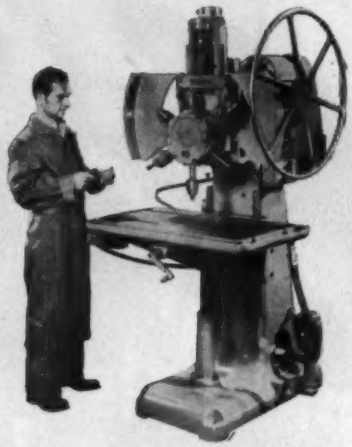
Private investment, too, should show a gain in 1956. Producers' durable equipment expenditures will be up about $3.5 billion. Private construction, paced by industrial and commercial building, will top the previous year's total, as it has for the last 11 years.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	146.9	146.5	126.7
Steel ingot production (thousand tons)	2,372	2,400	1,874
Electric power output (million kilowatt hours)	10,853	10,659	9,357
Production of automobiles and trucks	207,058	188,283	116,575
Engineering construction awards (*Eng. News-Record*, millions)	$267.9	$394.0	$371.5
MONTHLY BUSINESS INDICATORS	**Latest Month**	**Preceding Month**	**Year Ago**
Refrigerators sales (thousands of units)	311	323	233
Vacuum cleaners sales (thousands of units)	256	208	185
Washers sales (thousands of units)	404	246	291
Household electric ranges sales (thousands of units)	76	87	74
Radio production (thousands of units)	948	718	992
Television production (thousands of units)	648	344	604
Gear sales index (1947-49 = 100)	217.6	201.7	135.1
Foundry equipment new orders index (shipments, 1947-49 = 100)	134.0	213.8	68.1

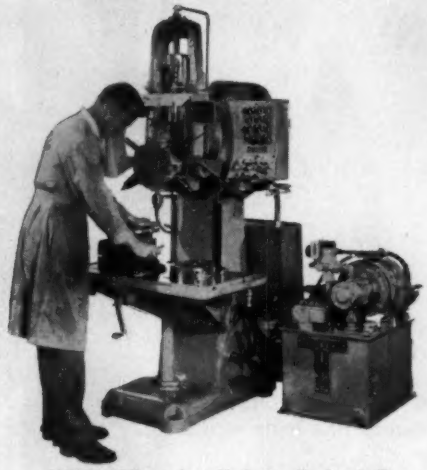
*Seasonally adjusted



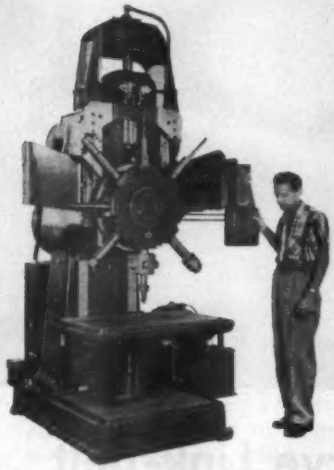
MODEL 2A—hand operated, 6-spindle



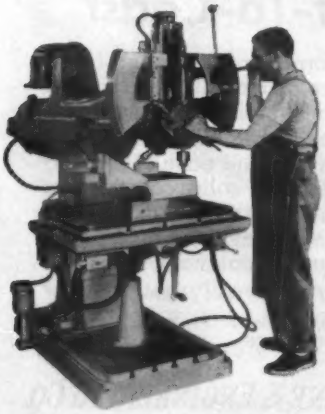
MODEL 2B—hand operated, 6-spindle



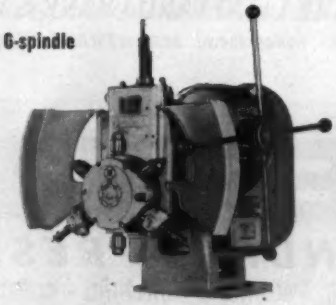
MODEL 2BH—automatic hydraulic, 6-spindle



MODEL 3BH—automatic hydraulic, 8-spindle



MODEL 2BR—ram type radial, 6-spindle



MODEL NO. 2BF—flanged mounting; can be mounted in any position for special purpose set-ups

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The BURGMASTER Turret Drill is designed to eliminate a large part of wasteful handling which research proves takes up as much as 50% of machining time. Here, in one highly versatile machine, drilling, reaming, counterboring, countersinking, spotfacing, tapping, O. D. threading and numerous other secondary operations can be accomplished by one operator. Ease of setup and operation makes the BURGMASTER adaptable to very short as well as long runs of parts—a machine that will cut your second operation costs. We will be glad to send you specific information as to how this versatile machine can benefit your operations.

Automatic hydraulic BURGMASTERS feature skip indexing, automatic cycling and infinitely variable pre-selective feeds. All models provide power indexing, pre-selective spindle speeds and very close pre-selective depth control. These features mean—faster production, more accurate parts, less maintenance—more profit for you.

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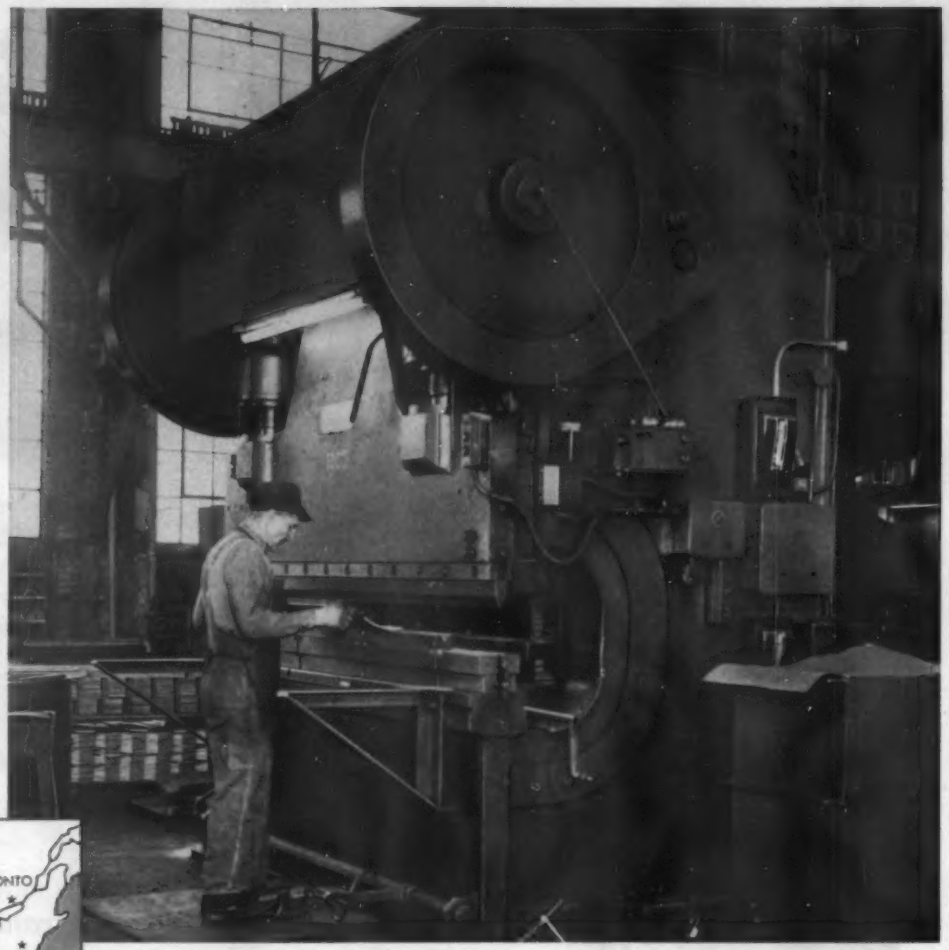


Installed in the Chicago plant in 1948, this 260 ton capacity machine, Model J4½-6, forms the smaller and lighter gauge conveyor panels. Illustrated is a curved section being formed of ⅜" plate to a radius of 8".

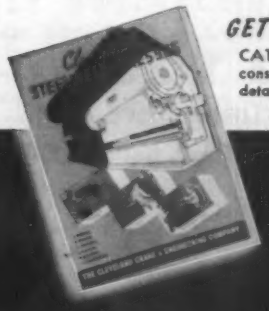
STEELWELDS Serve Link-Belt Plants *From Coast-To-Coast*

NINE LINK-BELT Company plants located from California to Pennsylvania, Texas to Ontario, Canada, and in Transvaal, South Africa, have one to six Steelweld Presses and Shears. Nearly every year since 1944 more Steelwelds have been purchased. Slightly over half of the machines are shears.

As a large manufacturer of a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment, Link-Belt plants must shear and form a great amount of steel plate. From experience, Link-Belt has learned that Steelwelds are outstanding for this work.

There are several reasons for this. For instance, the accessibility of controls and ease of making adjustments. The all-around solid construction that permits continuous operation with hairline accuracy. The heavy, well designed machinery which requires minimum maintenance.

Like Link-Belt, when you really get to know Steelweld Bending Presses, you, too, will be elated with their performance.



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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Antidote for a Lethal Combination

Just why is so much pressure being exerted these days to pare production costs?

If you will look at what's happening to wages and to prices of raw materials and of industrial products, the answer is clear.

General Electric recently negotiated a five-year agreement with the IUE-CIO that illustrates the wage trend. The agreement contains these hourly rate increases: 3% this year, an additional 3% in 1956, still another 3% in 1957, a further 3.48% in 1958, and finally 3.46% more in 1959.

The minimum yearly raise for employees is pegged at 4½ cents an hour in 1955, and at 4½ or 5 cents in each succeeding year during the life of the contract. Written into the agreement is a cost-of-living escalator clause granting an average increase of 1 cent an hour for each one-half point gain in the federal government's price index.

This is not all, of course. There are plenty of so-called fringe benefits, such as more insurance, better pensions, longer vacations, and pay for jury duty.

This wage pattern, mind you, is not confined to factory workers. It embraces highly-skilled hourly and salaried employees, whose increases are substantial too.

What's going on in General Electric is going on elsewhere. The general framework of agreements is the same at General Motors, Ford, Packard and many companies large and small outside the automobile and electrical goods industries. With variations, it applies throughout American industry, extending far beyond Metalworking.

Even though the majority of manufacturers may not have long-term contracts with their employees, the upward push in wage levels the next few years is inevitable.

Along with this steady and seemingly endless rise in the cost of labor is an upward movement in prices. It shows up, first of all, in healthy price hikes in raw materials, such as steel and copper.

More than that, there is a clearly discernible inching up of prices of all kinds of industrial products. The American Machinist Index of Metalworking Prices has unobtrusively crept up from 132 a year ago to 139 today. Significantly, it has risen a point in each of the past two months. There is no good reason to believe that it will stop its upward course at this time.

Writing recently in the New York Times Sunday Magazine, famed Harvard economist Sumner Slichter predicted that "the current boom has renewed the belief of many people that a slow long-term rise in the price level will be exceedingly hard to prevent."

This lethal combination of soaring wages and mounting prices is a chief contributor to management's relentless drive to lower production costs. It is one of the main reasons why metalworking companies are planning to spend almost $4.4 billion during 1956 on new plant and equipment. This figure, which has emerged from a survey just completed by the McGraw-Hill Department of Economics, is $1.5 billion more than in the current year and represents an all-time high.

Yes, the heat is on to get costs down and to push productivity up. The replacement of old equipment with new, the retooling for manufacture of new or redesigned products, and the building of new capacity will have exactly those effects.

The inevitable question is: What spot are you in as you come face to face with the irresistible forces of higher wages and higher prices? If you do not yet have a good answer, you had better be formulating one—and quick!

Burnham Finney

EDITOR

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GUARANTEE
on material
and workmanship;
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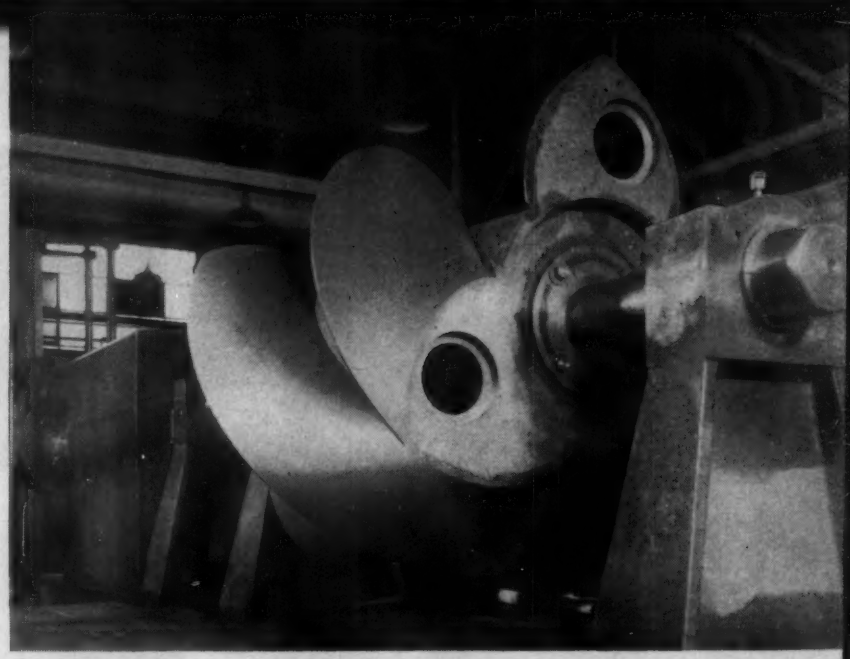


Three-lobe male rotor...

finish machined on a universal horizontal boring mill. At first it was impossible to find a machine tool that would do this particular job. Some rotors were planed, but not too successfully. A peculiar movement is required for cutting the male rotor because the generating female-rotor cutting tool must rotate and move longitudinally across workpiece, while the helical gears rotate and move the work in a lateral direction. Tooling for production of male and female rotors was dictated by geometry of the curves

EXPERT OPINION: *'It can't be done'*

RESULT: *These engineers did it . . .*

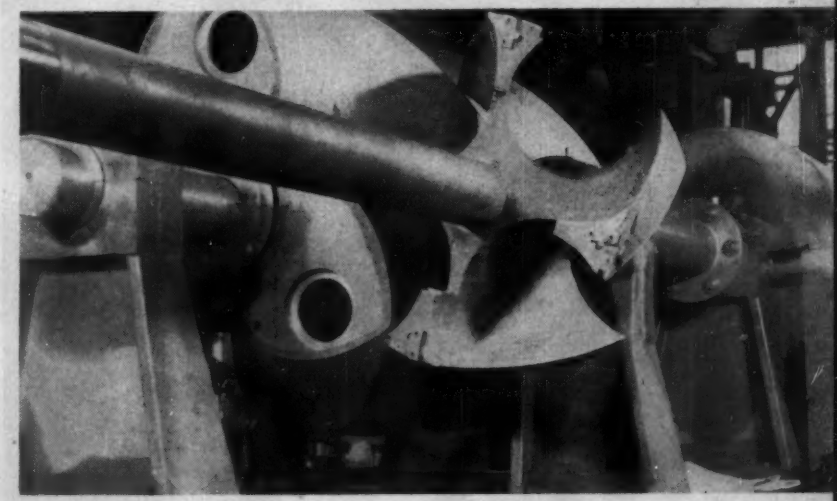
HERE'S HOW: We machined the impossible

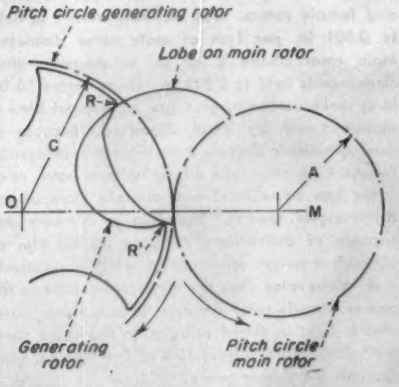
Read Standard has a line of axial-flow blowers which have a weird shape. Mathematical calculations indicate they're highly efficient, but nobody would try to make them. Finally, R-S figured out its own machining solution—one of the few we've ever heard of in which shop practice and theory are in perfect agreement. Here's how they did it

NORRIS H WHISLER, plant superintendent READ STANDARD CORP, YORK, PENNA

Lobes of male rotor are machined . . .

by a tool holder in the form of a matching gate rotor (female). Carbide tips are mounted at the radii of generating rotor tool and they machine the lobe flanks as the male rotor pitch circle revolves around the generating rotor. Dimensional tolerances are held to ±0.001 in. on all rotors—this one is 43 in. in dia and made in lengths from 38 to 60 in.

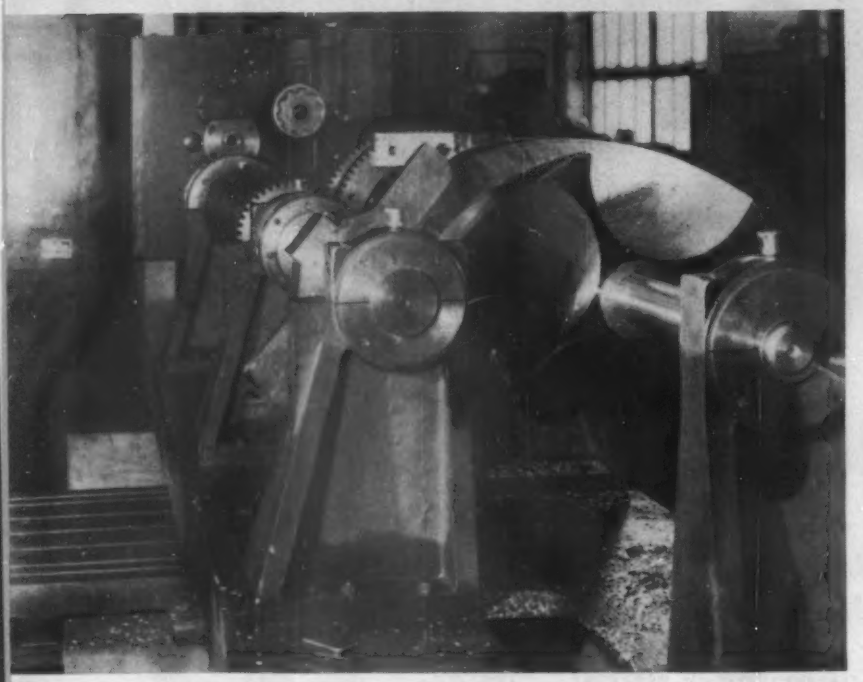


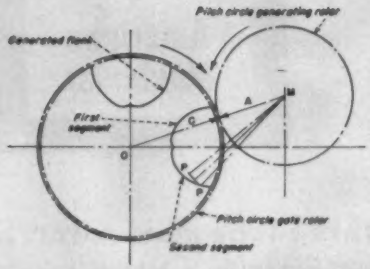


Basic curve of the male or main rotor . . .

is extremely complicated. It can best be defined as a "tangent to a family of extended epicycloids formed by an infinite series of points on a radius tool that simulates the gate-rotor tip radius." Referring to diagram at left, consider a gate rotor that has been machined by a radius tool in the manner just described. As the tool rolls on its pitch circle, radius C with center O, about the pitch circle of the main rotor, radius A and center M, the radii tips at R and R' will describe flanks of a lobe on the main rotor

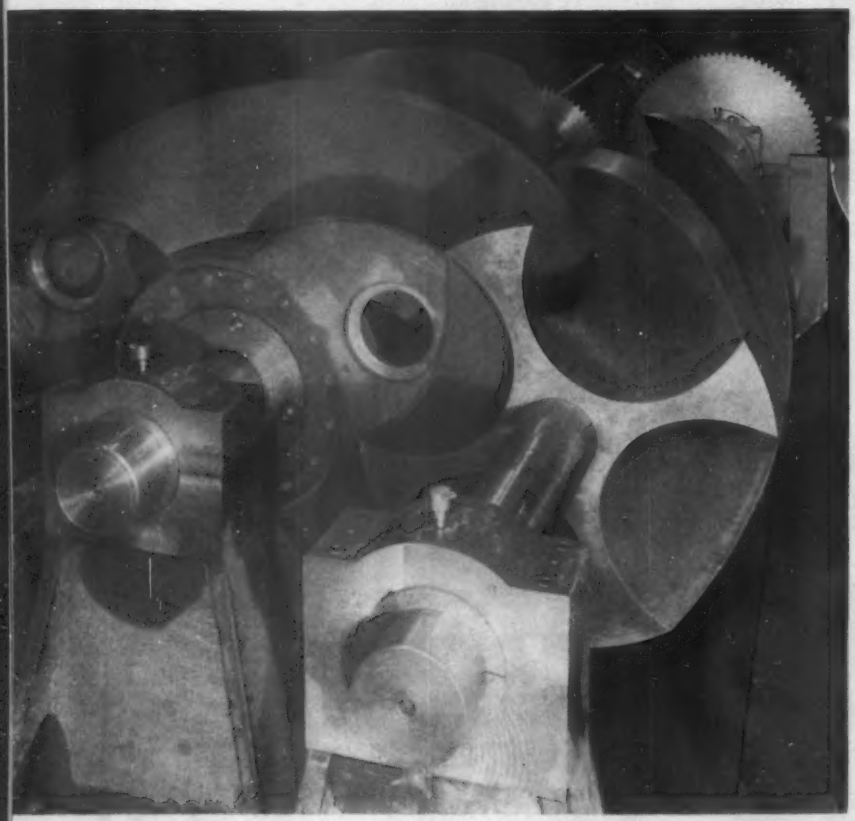
PLEASE TURN PAGE



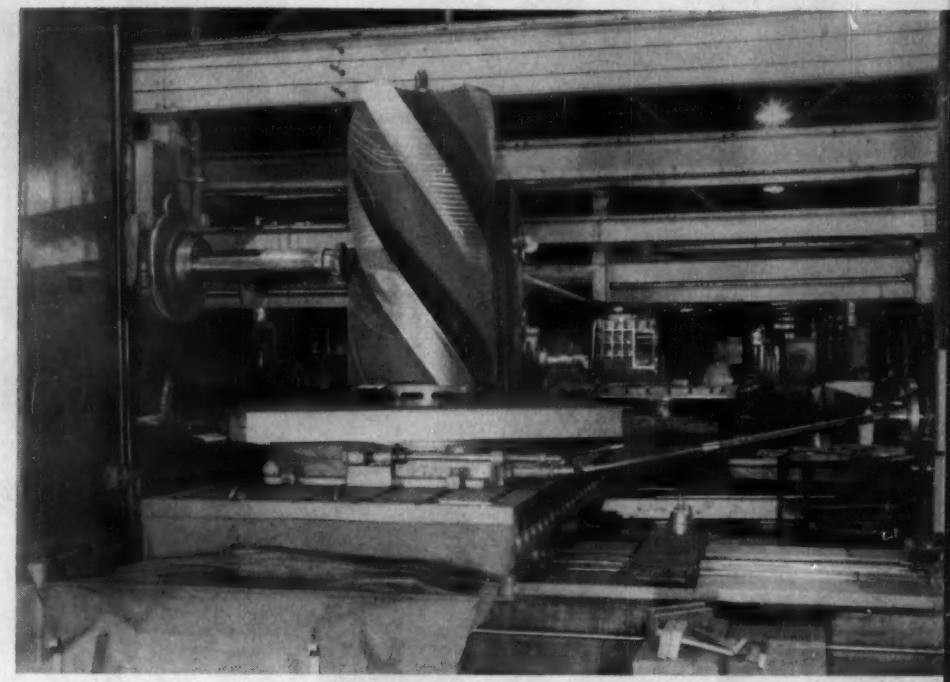


Four grooved flanks of female or gate rotor are formed by two short epicycloids. Flanks are generated by the two points P, which are a fixed distance from center M from a given circle of radius A. As the pitch circle of the generating rotor rolls tangentially to the gate rotor pitch circle, radius C about center O, each of points P generate a section of the curve. If points P were on the circumference of the circle, the resulting curves would be true epicycloids

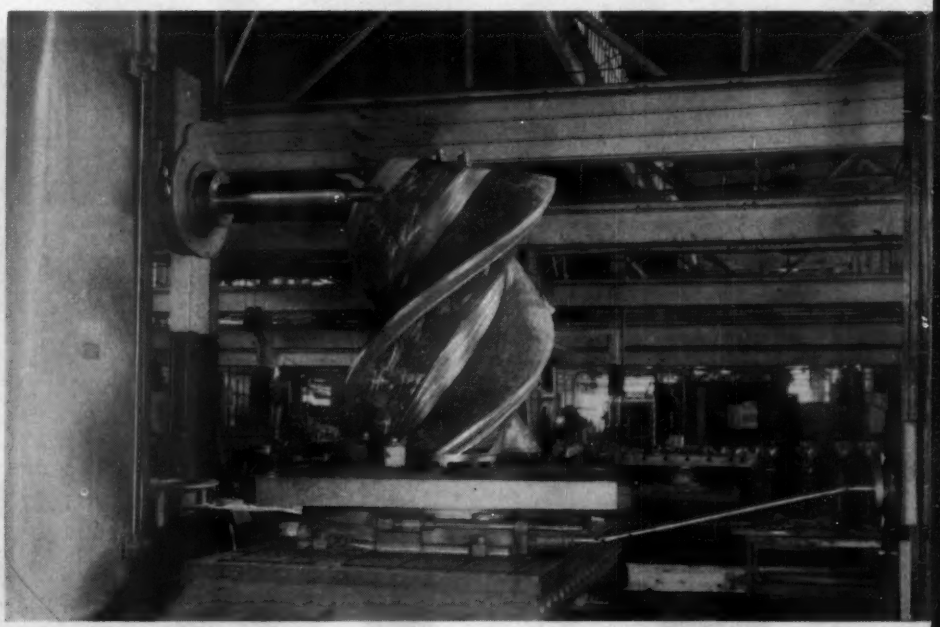
Female rotor being machined by two carbide tips mounted at points P at end of arm rotating around center M. As tool rotates, first one segment of curve is cut by leading point P; then second segment is cut by trailing point P. Rotor is set up on on a converted horizontal boring machine which mounts two special fixtures each consisting of bearing pedestals and arbor, mounted on a base. One fixture is mounted stationary above boring-mill table, which allows the table to move longitudinally the full length of its ways. Arbor, helical pinion, and carbide cutters on this fixture are driven by the boring-mill spindle. The helical pinion meshes with its mating gear mounted on the arbor of the second fixture, which in turn is bolted to the boring-mill table and fed in a longitudinal direction. The helical gears are designed for the correct lead through a 1:2 ratio, transmitted to the workpiece and cutter



Checking fixture set up for a center-to-center distance of 25½ in. to measure amount of intermeshing clearance between the male and female rotors. Gap between rotors is held to 0.001 in. per inch of main rotor diameter. Main rotor above is 43 in. in diameter—thus clearance is held to 0.043 in. These rotors 50 in. long make up the largest size high-speed blower manufactured by Read Standard. Because of their geometric shapes, the rotors are inherently resistant to any type of deflection, have relatively low noise level and operate from direct-drive motor speeds. These large blowers are capable of delivering 10,000 to 30,000 cfm of air with a power consumption which is relatively low. Main rotor does the work and consumes the power; female rotor simply acts as a valve (gate) and is kept in timed relation to the drive rotor by helical gears. About 10% of input power goes through the timing gears



Turning OD of female rotor on a Giddings & Lewis horizontal boring mill. Rough machining must be done on large rotors preliminary to precision machining to secure economical production. This is not a complex operation when you exclude the especially designed adapter for the rotary table; however rough milling the flanks of the rotors is a different story . . .



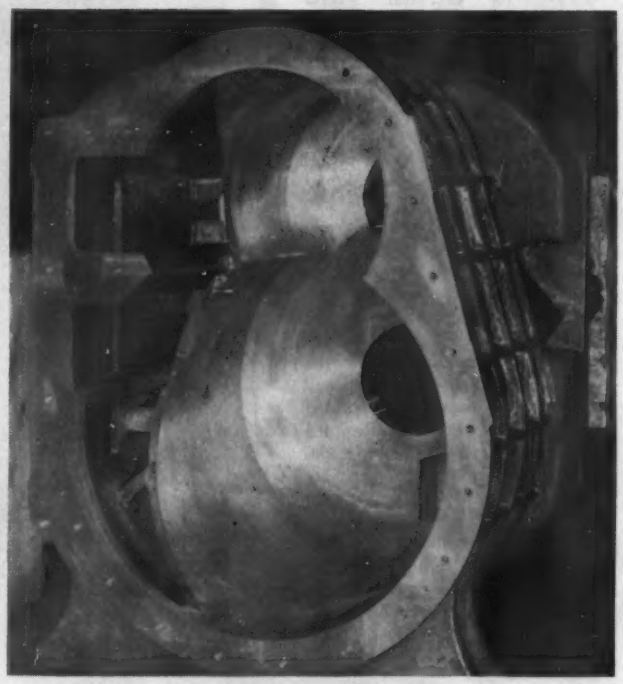
Experts again said that it couldn't be done, but the company's tool engineers just went ahead and did it. Rough milling the flanks of main-rotor casting is accomplished by synchronizing the vertical motion of the headstock through a gear train and telescoping drive rod to the special adapter on the rotary table. When the spindle of the G & L boring mill moves vertically a given number of inches, the rotary table revolves a given number of degrees. With a staggered-tooth cutter of proper profile mounted in the spindle, the headstock is fed down into the rotor, taking a cut ⅜ in. deep and 3 in. wide. Because the cutting process is one of generation, the cutters must necessarily be conjugates of rotors to be profiled. For instance, cutter for female-rotor generation simulates the male-rotor crest and the cutter for the male rotor simulates arcuate tips of the female rotor

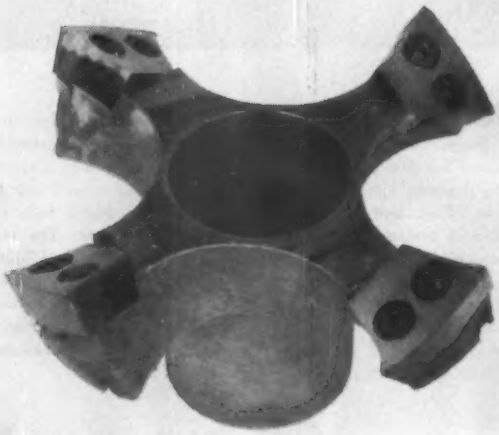
Male and female rotors assembled in the housing. Feeler gages are being used to establish end clearance between rotors and flanges. Diametrical clearance between the rotors and housing depends upon size of blower and ranges from 0.005 to 0.015 in. Each unit is tested according to the ASME code at speeds and pressure well above operating conditions. The test includes both airflow and horsepower measurements. These high-speed blowers work on the principle of two intermeshing screws or rotors. The two rotors actually never touch, therefore they do not wear and do not require lubrication. As the clearance between them is so small, a continuous air seal is provided throughout the entire rotation

PLEASE TURN PAGE ▶

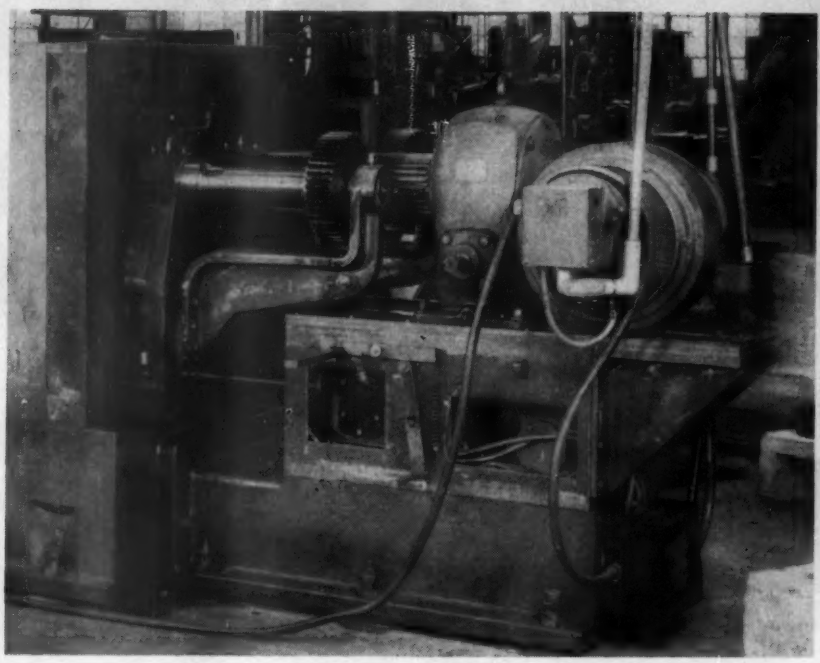
Boring the blower housing for the rotors, which can deliver 15,000 cfm of air. Housings are cast from either bronze or cast iron machined to diametral tolerances of 0.002 in, surface finish of 63 mu. in. rms, and alignment of bores to each other, as well as squareness to other machined surfaces is held to 0.001 in.

Interior of a blower housing completely machined. A weight of air equalling 318,150 tons can be moved by one of these blowers when run at full capacity for 24 hr a day, 365 days. Normal operation is at 8 psi and 665 rpm. The blowers actually work on a compressor cycle. Compression in a given pocket starts at inlet pressure and air is gradually compressed internally toward discharge pressure. During this cycle, average pressure is considerably lower than discharge pressure—a distinct saving in power. The air stream is screwed into the rotor pocket with an even flow and discharged in a similar manner. There is little backflow of discharged air into rotor pockets as they open to the discharge. Absence of backflow reduces pulsations in blower and piping. Either labyrinth or mechanical face-type seals restrict flow losses from blower housing



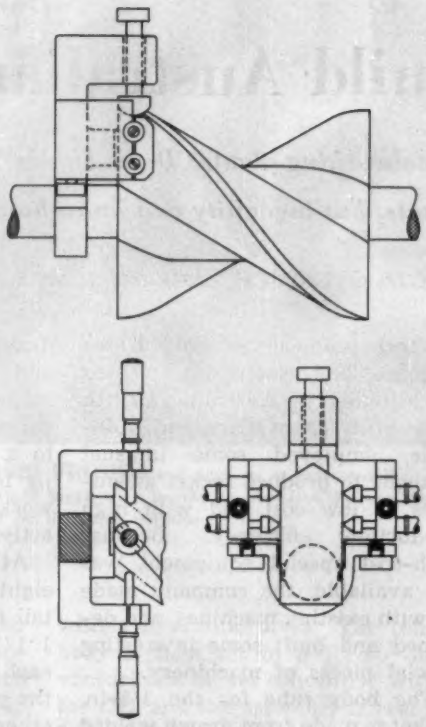


Converted Fellows gear shaper produces small male and female rotors on a production basis. As rotors are basically gears (main rotor being all addendum and female rotor being all dedendum) the tool engineers believed it possible to produce them on a gear shaper. Against the advice of outside experts, the engineers went ahead with their idea and today they are machining rotors up to 6 in. in diameter and 4 in. long for blowers of 100 cfm. The toolholder and cutter (shown left) are a conjugate of the form being cut, and move vertically through special helical guides that give the correct lead to the male rotor. Change gears in the shaper provide the proper ratio of work to cutter rotation. Tolerances are held to ± 0.001 in. in the gear-shaper setup

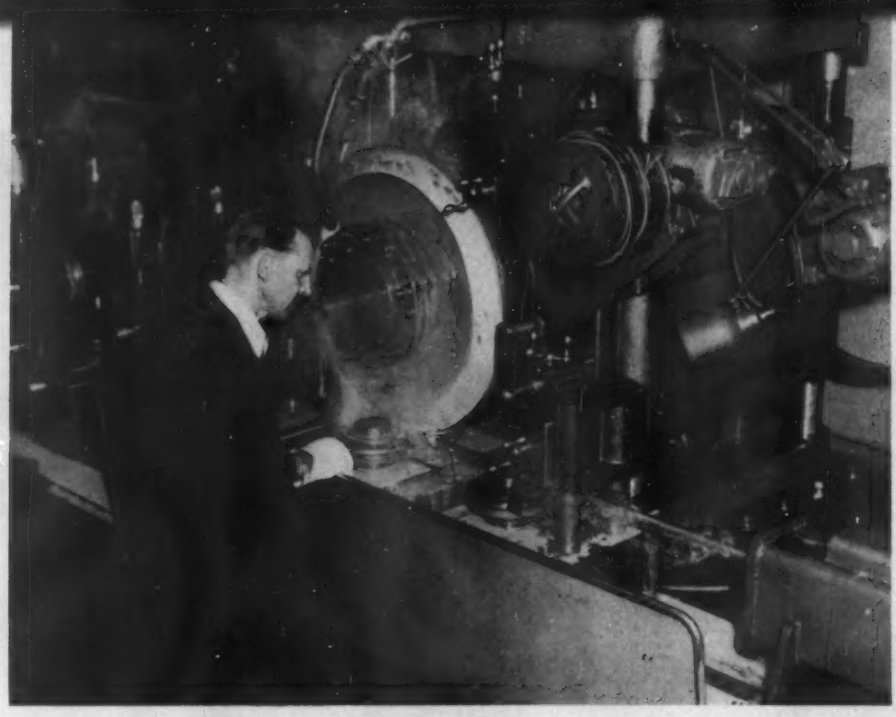


Duplex generator of a special design made it possible to generate either two male rotors or two female rotors, and cut their outside diameters at the same time. Generator was built in Read's plant and is similar to the special fixture built for the boring mill, except two rotors can be generated simultaneously. Female and male rotors are machined from either cast iron, ductile iron or bronze castings. Two pairs of carbide toolbits are located to simulate crest of the main rotor. Each pair of bits must be located 180° apart or they will cut a drunken rotor. By setting the distance between the axis of the toolholder and axis of work equivalent to blower-shaft center, the proper rotor profile is automatically generated. Work and tool arbors are driven by helical gears that have proper gear ratio for required index and helix angle

Generating two male rotors on the Duplex generator requires four toolbits mounted 90° apart at the radius tips of toolholder. One set of toolbits has a cutting action similar to a knife, while the other set has a cutting action similar to a shaving tool. Knife bits are so designed that they cut the flank of the main rotor with a draw stroke which begins at the root or bottom of the curve. Push bits start their cut on the OD of the main rotor and push the chips ahead of themselves during their cutting strokes. Both the knife and push bits roll about a radiused cutting edge, which results in a constantly changing rake angle. Same setup is used for female rotors, only gear cutter and gears are changed



Percentage of rejects, while currently low, is constantly getting better through the use of a four-point micrometer gage for checking the symmetry on the flanks of main-rotor lobes. Gage, designed by the tool engineers, has four micrometers mounted on a generating arbor, which is clamped symmetrically about the center-line of the rotor while readings are taken on each mike



TUBULAR BODIES for 3¼-in. rocket are rolled from steel strip and welded on Etna Weldmill, then drawn to exact diameter on adjacent Drawmill

Ingenious methods build Australian rockets

Metalworking plants "Down Under" may not be as well equipped as corresponding American plants, but ingenuity and know-how make up the deficiency

ALICJA GROBTUCH, McGRAW-HILL WORLD NEWS, MELBOURNE, AUSTRALIA

Largest producer of cold-drawn seamless and electrically welded steel tubing in Australia, British Tube Mills (Aust) Pty, Ltd, Adelaide, employed some unusual methods to produce rocket assemblies at low cost and with high production efficiency. Because high-cost special equipment was not available, the company made do with existing machines, and designed and built some interesting special pieces of machinery.

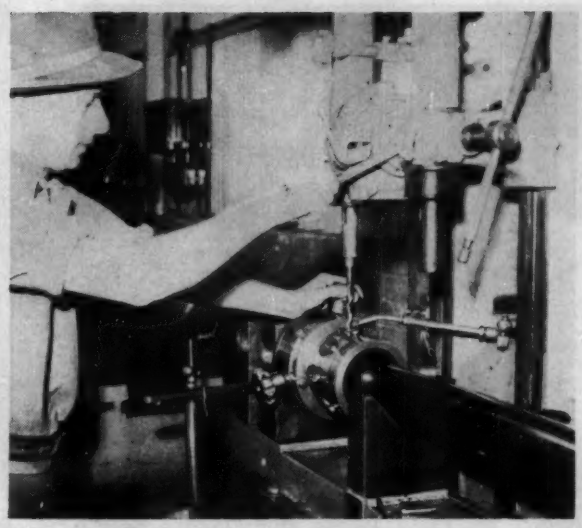
The body tube for the 3¼-in. rocket is made from drawn welded tubing, previously imported, but now produced on an Etna electrical resistance Weldmill, and drawn in an adjacent Drawmill. The finished size is 3¼-in. OD, by 14-gage, and the material is a general-purpose, low-carbon steel. Tubing is precision straightened in the drawn lengths, trimmed to length, and eight holes are drilled and reamed to close limits. Geometrical relationship of the holes is held to ± 0.0005 in., and a collet-type jig insures exact centering of the work so all holes are drilled exactly radial.

At the opposite end of the tube, eight slots are pierced for the four tail fins. They are 0.053 in. wide, 1 1/16 in. long, with a radius at each end, and are positioned from the previously reamed holes at the other end. The press is equipped with a precision limit switch to insure that the tube cannot be pierced unless it is correctly positioned. Tubes are degreased, deburred, and inspected, then put through a phosphating process in preparation for internal and external painting. Following this operation, the parts pass into the "clean area" where they are prepared for fitting the obturator and venturi by buffing off a part of the phosphated surface at the slotted end in preparation for inert-gas-shielded (Argonarc) welding.

MACHINING THE VENTURI

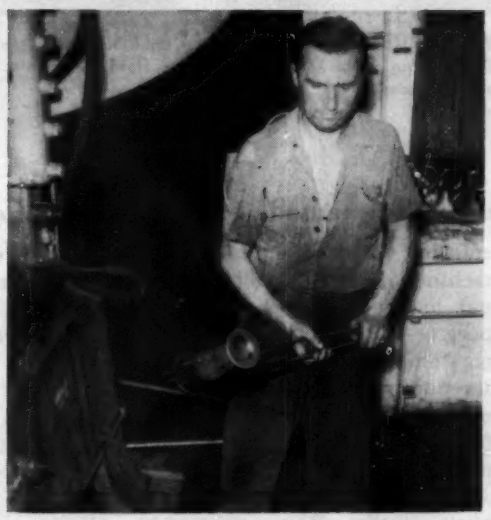
The venturi is made from hot-finished seamless tubing, 3⅝-in. OD, 5/16-in. wall thickness, and is drawn down to a 3¼-in. OD, 0.197-in. wall. It is cut into 18¼-in. lengths to produce two venturis. The material is a fully killed steel containing 0.10 to 0.15% C, 0.3% max Si, and 0.3 to 0.6% Mn. The cut lengths are heated at one end and swaged in an Etna rotary swager; then the opposite end is similarly heated and swaged and the piece cut in two. The blank is

COLLET-TYPE DRILL JIG insures that eight holes will be exactly radial and that geometrical relationship will be within close limits. These holes serve as locating points at next operation



TAIL-FIN SLOTS are pierced in opposite end of tube, with their position controlled by the drilled holes. The press is operated from the rear by remote control. Interlock prevents press from operating unless work is properly positioned

VENTURI TUBES are hot swaged at both ends, then cut in two to make two units. Machine is an Etna rotary swager



SWAGED VENTURIS are sized on a taper mandrel in a vertical press, then heated at the small-dia end and flared on the same machine

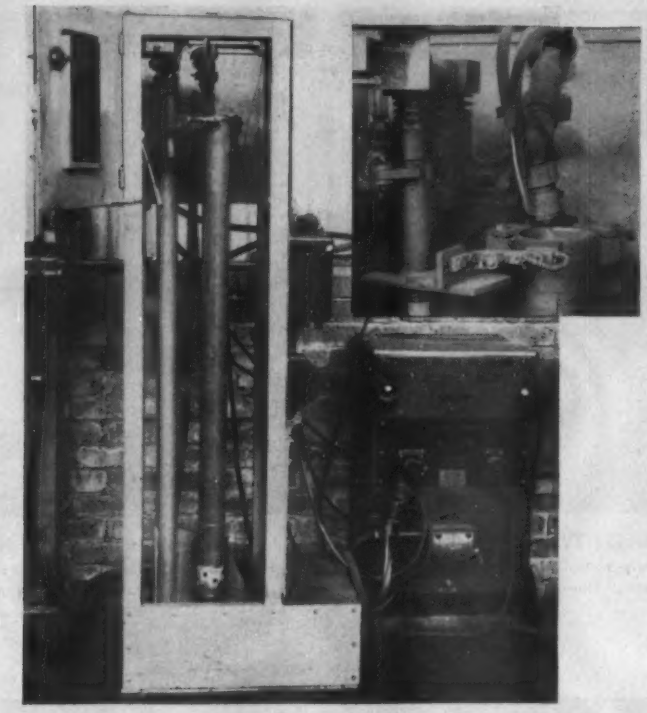
sized on a tapered mandrel in a 100-ton, 24-in. stroke, vertical, mechanical press. In a second operation, it is locally heated in an oil furnace and flared, using the same mandrel in conjunction with a flaring punch. The special design of the flaring tool has permitted an appreciable decrease in the wall thickness of the straight tube, resulting in a marked reduction in machining time.

Inside and outside surfaces are machined in a George Fischer copying lathe which removes approximately 1/16 in. from each surface at a spindle speed of 900 rpm and a feed of 0.018 ipr. After inspection, the parts are phosphated and taken to the clean area where a small section of phosphating is buffed off one end to prepare it for welding.

The obturator and venturi are placed in the tail of the rocket tube and press fitted to welding position with a hydraulic press. The tube body is then set in a jig so the venturi can be set concentric with the OD, and the assembly is ready for welding.

To obtain maximum production, it was considered desirable to reduce the Argonarc welding process to a simple, repetitive operation, so a special machine was designed with the assistance of Commonwealth Industrial Gases Ltd. The rocket assembly is held in a self-

SWISS-MADE George Fischer copying lathe machines ID and OD, removing about 1/16 in. from each. Note the templet at operator's knee level



ARGONARC WELDING machine developed by plant engineers has chuck in base to center and rotate work. Pushbutton control makes weld cycle automatic. Welding head swings into position when safety glass door is closed (inset). Action also starts flow of argon shielding gas

Ingenious methods build Australian rockets . . . continued

centering chuck in the base of the machine to insure correct and identical location of each unit. The operator closes the glass-fronted door, and this activates the welding equipment, turning on the argon flow for the required number of seconds before welding starts, and automatically positioning the torch. Pressing the switch to start chuck rotation also turns on welding current. The operator watches one revolution of the rocket, then presses the "Off" switch to cut off welding power and stop rotation. The job requires only 60 sec.

INTERNAL SPRAY PAINTING

A special setup was required for internal painting, and assistance was furnished by Australasian United Paint Co Ltd. The first coat, known as the *A* coat is a special refractory paint, the two *B* coats being resin varnish. The refractory paint provides an insulating barrier between the burning charge and the steel tube and is so effective that the temperature of the tube is reduced 570 F during firing of the rocket.

The *A* coat is a special mixture of micronized alumina, sodium silicate, and water. It is applied to a controlled thickness of between 0.006 and 0.012 in. and is baked at 500 to 600 F. The paint is exceedingly prone to settling out, and each new container must be mechanically agitated for 16 hr before use, then continuously agitated while in the pressure pot during actual spraying. Addition of a half-pint of wetting agent to four imperial gal of paint has been found beneficial.

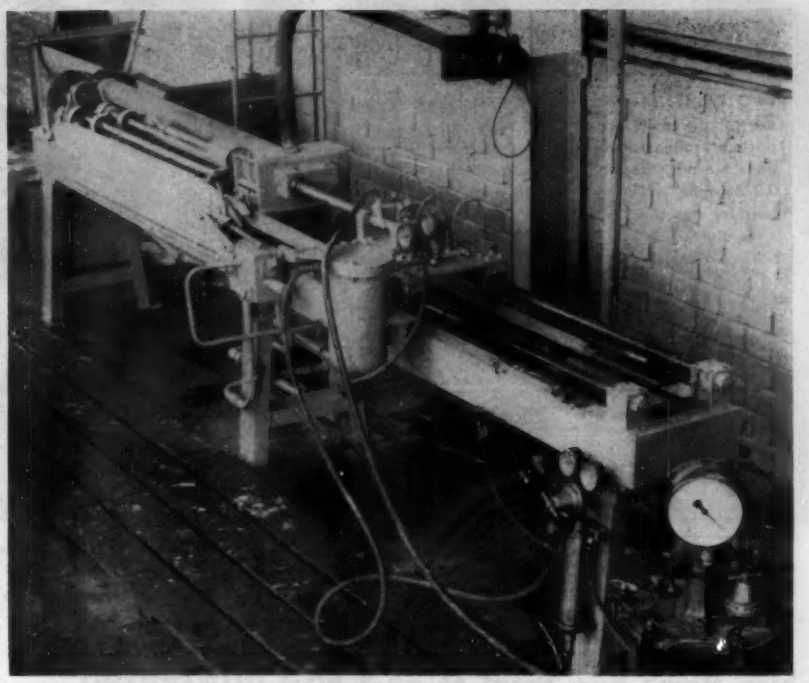
Experience showed that paint temperature should be not less than 70 F nor more than 150 F, and the body assembly should be pre-heated to between 180 and 210 F to fix the paint immediately it settles on the work surface. A pot pressure of 12 to 15 psi, with 25 to 30 psi for the atomizer nozzle gave the best results.

The resin varnish coats are applied on the same machine, each coat being baked at 250 to 300 F. To permit opening the needle valve sufficiently to prevent blockages, a pot pressure of 1½ to 2 psi is applied, with an atomizer pressure of 30 to 36 psi.

The specially designed machine can spray two parts at once. They are rotated by laying them on electrically driven rollers which turn them at a peripheral speed of 300 fpm. The paint nozzles are attached to long shafts and are fed through the tubes to the starting position at the far end at 24 fpm by hydraulic cylinders. Immediately the nozzles reach the venturi, air valves operate relays which open the paint needle valves and supply air to the atomizer caps. At the same time, the hydraulic mechanism withdraws the nozzles at a speed of 7 fpm. At the required position, spraying is automatically stopped by an adjustable trip which insures that paint is applied only over the required area. As there are one *A* coat and two *B* coats, the machine has two

spindles, and the schedule is set up so an *A* coat is sprayed on one side and a *B* coat on the other for two-thirds of the production time, and two *B* coats for the remaining one-third of the time.

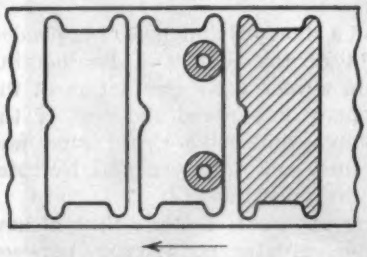
The OD is painted with two coats of deep bronze green by using a conventional spray gun fitted to a mechanically driven screw feed which passes it along the length of the rotating body. It is started and stopped by precision switches built into the airline circuit. Marking and stencilling follow, then the assembly is heated in an oven to 200 F approx. It is inspected quickly by government inspectors to insure that it is still warm when the protective caps are installed over the ends and taped in place, after which it is packed in a metal case. The purpose of this is to insure that it will be received at the loading plant in good condition and free from moisture for filling.



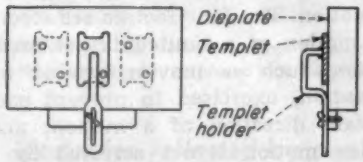
INTERNAL SPRAY painting machine automatically applies coat of insulating paint in one position, resin varnish in second position. Cycle is automatic

Diemaker's Kinks

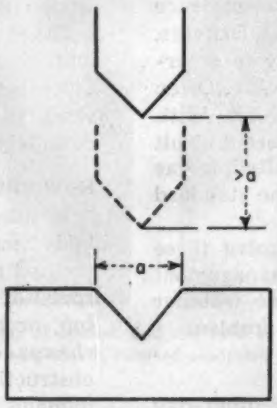
FEDERICO STRASSER



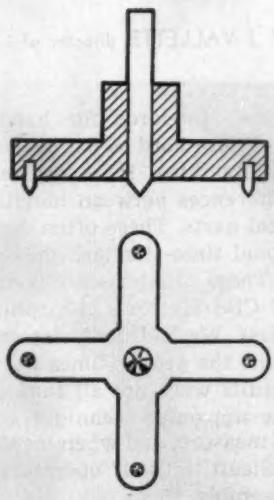
STOP PINS IN PAIRS, instead of single ones, should be provided when blanking wide parts in progressive dies. With a single stop pin, a slight inaccuracy in strip feeding or alignment will likely produce defective work.



AN ADJUSTABLE TEMPLET holder is convenient when laying out progressive dies. Often it is necessary to copy the templet several times on the dieplate. The templet is soldered to a holder which in turn is fastened to a straightedge with a wing screw. Parallel outlines of the templet may now be scribed on the dieplate, and piercing holes and other apertures added.

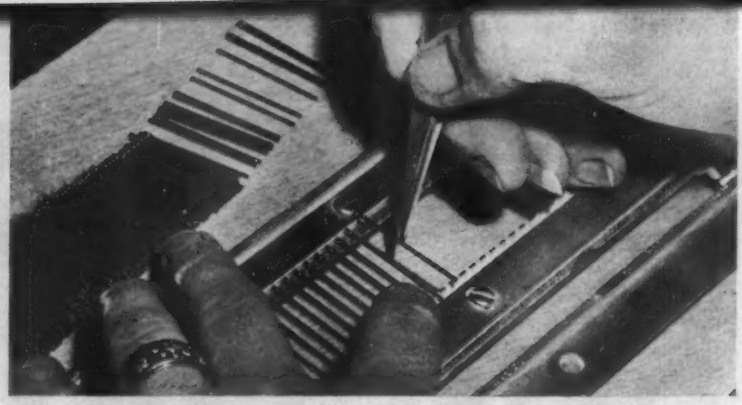


PRESS BRAKES should have a stroke equal to or greater than the die opening, so that forming starts at or below center of the down stroke.



CENTER PUNCHES are made in many types. Here is one that I like for accurate work: Fit sharp-pointed pins into the spider arms so that they lie on lines at right angles and intersecting at the center of the central hole. Fit a center punch into that hole. Now, to set the center punch exactly over the proposed center, place the device so that the four pointed pins are on the intersecting lines scribed on the work.

TWO PARTS, of almost identical size and shape, are compared in this analysis. Although these two parts are almost identical, the times for the operations are not, the longer of the cathodes requiring 0.0263 min, while the smaller takes 0.0255 min, because the shorter length is easier to assemble



TYPE _____ WORK FACTOR CBS-HYTRON ANALYSIS SHEET DATE 2-24-55 PAGE ___ OF ___

NO. Long Cathode OPERATION Sleeve to Book Rack PLANT _____ DEPT. _____ ENGINEER _____

	LEFT HAND			CUMULATIVE TIME			RIGHT HAND		
NO	ELEMENTAL DESCRIPTION	MOTION ANALYSIS	ELEM. TIME			ELEM. TIME	MOTION ANALYSIS	ELEMENTAL DESCRIPTION	NO
1	Get Cathode Against Rod	F1	16	16	41	41	V3RS2	R to Sleeves with Tweezers	1
2	R. Sleeve	Cr-Rl	–	16	56	9	(SE) 10%	Separate Sleeves	2
3	M Rack to Left	A1-20%	4	20			Obs-Tr-M2S	R. Tweezers to Sleeve	3
4					76	26	V3RS2B	RL	4
5					94	18	A1	Take Tweezers and Sleeve	5
6					110	16	F1	Ap. Sleeve	6
7	Hold Rack in Position	BD	131	151	151	41	V3RS2	M Sleeve to Rack	7
8							Comp Tr-M2S	Pry to Slot in Rack	8
9					229	78	V3RS	RL	9
10	Hold Rack in Position	BD	86	237	237	8	10% (PRPE)	Distance between Tabbets	10
11	R to Place Index Finger	F1	16	253	255	18	A1	Tab into Slot	11
12	on Sleeve		—		263	8	4 A1	R. in Slot	12
13	Ge Sleeve & Hold	G1-RR+BD	10	263					13
14									

OPERATION: Load sleeves into book racks for spraying

DESCRIPTION: Operator gets a cathode sleeve with tweezers, from a supply in work place area, and assembles sleeve to slot in fixture. Fingers of left hand seat sleeve in rack and move rack to left, as required, while right hand gets next sleeve

on those "ticklish" jobs.... MEASURE THE

Here's a method that worked well where others failed, for measuring time standards for delicate

W J VALLETTE, director of industrial engrg. CBS-HYTRON, DIV COLUMBIA BROADCASTING SYSTEM, INC. DANVERS, MASS

Time standards for hand assembly of electronic tubes are hard to fix, because the parts are light and fragile. Also, there are small but important time differences between handling similar but not identical parts. These often don't show up with conventional time-standard measurements.

These problems are pointed up by the experience of CBS-Hytron's electronic tube plant at Danvers, Mass. We had used stopwatch time study to determine the proper times for the tube assembly. Often results were not all that could be hoped for. With the stopwatch technique, small details were difficult to measure, and when inconsistencies resulted, it was difficult to "sell" operators on meeting the standard assembly times.

In June 1953, in another effort to solve these problems, we called in Work Factor Co, management consultant of Haddon Heights, NJ, to see whether its time-standard system could solve the problem.

TRAINING COURSES

The first step taken was a 4-hr, every-other-day training program for the entire industrial engineering department, from June to October of 1953. At the same time, appreciation courses were run for foremen, the union, and top management.

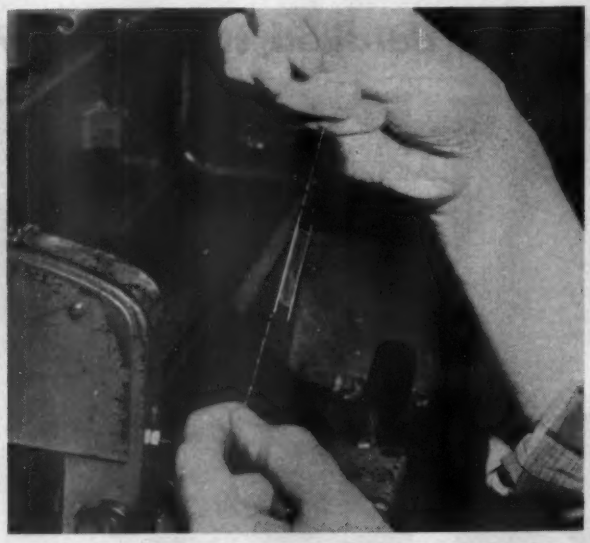
As a result of direct application of detailed Work Factor analysis and a standard data program, headed by George Martin of the Industrial Engineering Department, within a year after completion of the training, the company had saved the cost of the program. The savings came from better rates and better methods on new and improved jobs. No rates were cut on existing operations.

Other gains were apparent: better selling of new and changing rates, greater consistency between piece rates, more attention to better methods and work simplification, and, perhaps most important, definitely improved morale.

HOW THE METHOD DIFFERS

Besides its normal attention to such factors as body member and distance moved, the Work Factor method recognizes four variables which control the speed of a work motion. The four factors are *steering*, or aiming a motion at a limited target area; *change of direction*, such as moving around an obstruction; *precaution*, exercised to prevent part damage or maintain direction of a motion; and *definite stop*, when motion is not arrested by a physical obstruction.

It is attention to these factors that helps solve the kind of time-standard measurement problems shown here.



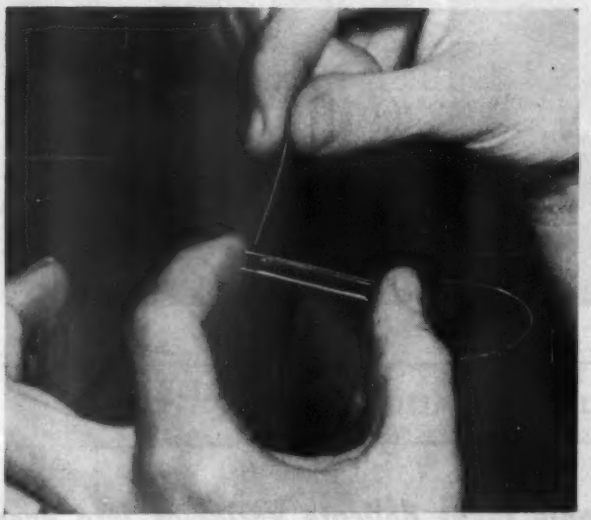
GRIDS HAVE LOOSE WIRES pulled out to swedged portion of side rods. Larger grid (left) is relatively less fragile than smaller one

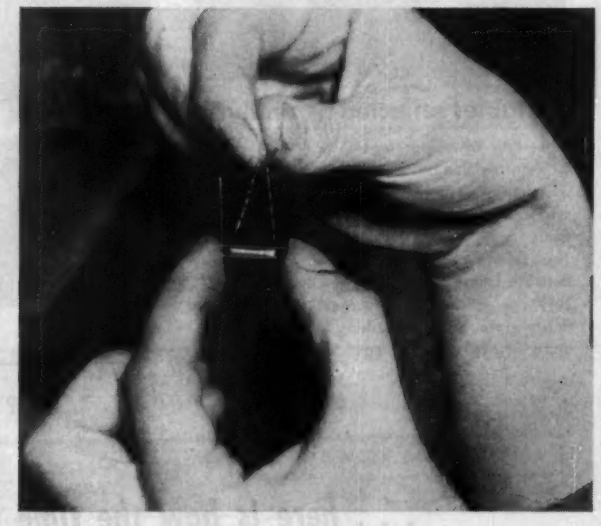
OPERATION: Grid trim of large and small grids

DESCRIPTION: Operator cuts grid to length from strip, and grasps loosely wound turns of wire on each end of grid, pulling loose turns out until wire unravels to swedged portion of side rod. Grid is then positioned by operator in left hand and loose wires are rotated until they break loose from the side rod. Finished grid is placed in tray

WORK FACTOR

hand assembly of electronic tubes





TRIMMING MOTIONS are about to begin. Loose wires of smaller grid are held so that both wires are trimmed together. On larger grid, each wire is trimmed separately

Variables reflected by analysis:

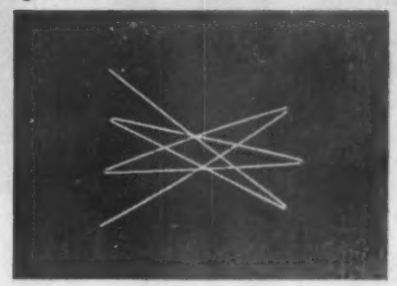
1. Length of wire pullout
2. Wires are on same side or opposite sides of grid
3. Relative fragility of grid
4. Size of grid
5. Number of trim motions required

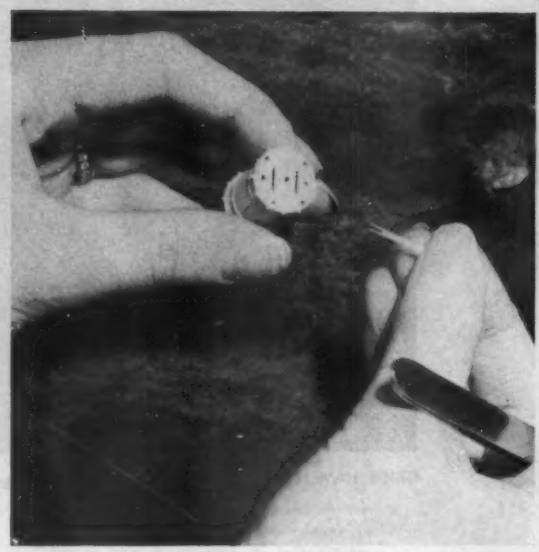
Small differences are reflected in the times for these two operations. The larger grid requires a 4-in. pullout, and non-simultaneous trim of the wires, with an average of 2 trimming motions per wire. The time required is 0.0801 min. The smaller grid differs, because the trim is simultaneous, with an average of 3 trimming motions required. Because the grid is fragile, more caution is needed during pullout. Time for the smaller grid trim is 0.0827 min.

. . . theory and practice: here are detailed studies of two

OPERATION:
Insert heater into cathode

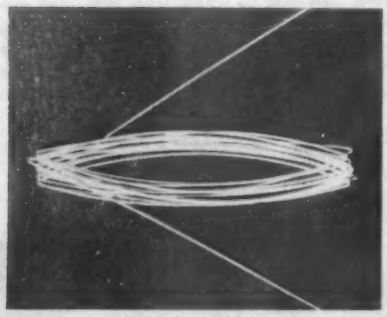
DESCRIPTION: Operator gets and palms a mount with the left hand while right hand places finished assembly in tray. Operator gets a heater from tray with left hand, gives heater to right hand, unpalms mount in left hand and holds for insertion of heater by right hand

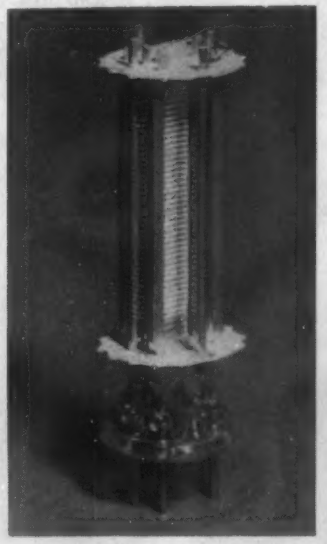


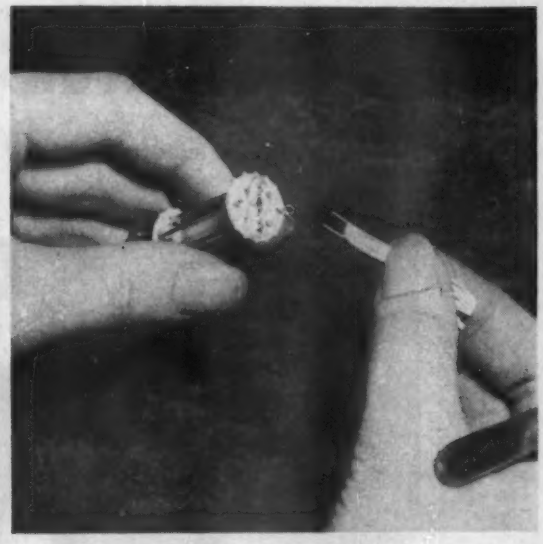


SIX-LEG, AND 26-LEG HEATERS, left, are inserted into cathodes of small and large tubes, respectively. Note differences in length, firmness, and ease of grasping

OPERATORS holding 6-leg and 26-leg heaters in position just prior to inserting into cathode







Variables reflected by analysis:

1. Length of heater legs
2. Relative flexibility of legs
3. Number of legs, tightness of fit in cathode, and dislodgements required on coating and folds

The analysis distinguishes between a *very* delicate insert (6-leg) and an *extremely* delicate job (26-leg). The larger insert requires much more careful pushing because of the more flexible, longer legs.

. . . here is how the time table takes delicate variables into account . . .

Motion-time table (facing page) from which values shown in these analyses were taken. This system takes into account these four factors: *steering, change of direction, precaution,* and *definite stop.* For example, in the analysis of "Load cathode sleeve to book rack", No. 1 value for left hand is F1, a basic finger motion, with no difficulties involved. No. 3 is A1-20%, a basic arm motion. However, No. 1 motion for the right hand is A3SD, which has 2 added "Work Factors"—"D" for definite stop, and S, for steering the tweezers to the sleeve. In the same way, when inserting the 6-leg heater, LH motion No. 1 is VA6D, the D being a definite stop before search and grasp. LH No. 7 is F1P, the precaution being to avoid crushing the delicate heater when the fingers close around it. RH No. 1 motion is A6SD, the D being a definite stop before assembly, and the S is steering the button to a location smaller than 2 in. RH motion No. 3 is ½ F1, a relaxing of pressure of fingers without releasing the part.

almost identical jobs–with motion-time difference of 13% . . .

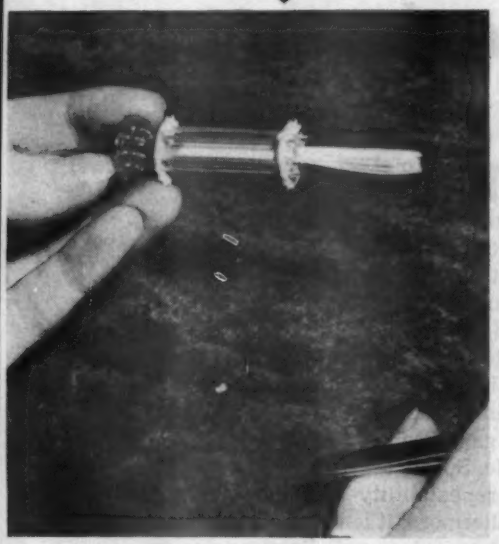
OPERATORS have just made initial insert and dislodgements on heaters, and heaters are at point where pushes begin

TYPE _____ WORK FACTOR CBS-HYTRON ANALYSIS SHEET (HEATER INSERT) DATE 2-24-55 PAGE ___ OF ___

NO. _____ OPERATION 6 LEG HEATER - ROUND CATHODE PLANT _____ DEPT. _____ ENGINEER _____

NO.	LEFT HAND ELEMENTAL DESCRIPTION	MOTION ANALYSIS	ELEM. TIME	CUMULATIVE TIME		ELEM. TIME	RIGHT HAND MOTION ANALYSIS	RIGHT HAND ELEMENTAL DESCRIPTION	NO.
1	R. TO TRAY OF 20° PORT MOUNTS	VA6D	47	47	60	60	VA6SD CMA T.=.470 R.=.885	M TO FINISHED PARTS TRAY	1
2	SEARCH	VA2D	29	76	91	31		ASY. BUTTON TO HOLE IN TRAY	2
3	GR. MOUNT	½FI	8	84	99	8	½FI	RL. MOUNT	3
4	CLEAR TRAY	A2	20	104	131	32	VA6	MOVE TO W.A.	4
5	PALM MOUNT	F2+F2+FI	50	154					5
6	M TO HEATER BOARD	VA6SD	60	214					6
7	GR. HEATER	FIP	23	237					7
8	WITHDRAW FROM BOARD	AI	18	255					8
9	MOVE TO R.H.	VA9SD	74	329	331	200	BD	WAIT FOR L.H.	9
10	GIVE HEATER TO R.H.	½FI+FIP	31	360	362	31	½FI+FIP	TAKE HEATER FROM L.H.	10
11	UNPALM & PP MOUNT	F2+F2+FI	50	410	412	50	BD	WAIT FOR UNPALM MOUNT	11
12					449	37	VA2SD	AP. CATHODE WITH HEATER	12
13					577	128	V3AISD+AIP	ROTATE & INSERT LEGS	13
14					660	83	(REPEAT ½) L5%	ROTATE & INSERT 2ND LEG - 65%	14
15					686	26	AIP	UPRIGHT & INSERT HEATER	15
16					712	26	(AIS+AIP)-50%	DISLODGE CRIMPS - 50%	16
17					764	26	(V3AIS+AIP)-25%	DISLODGE FOLDS - 25%	17
18					890	126	½FI+AIP&FIP	PUSH HEATER	18
19						—	+AIP)-VI½	- AVE. 1½ TIMES	19
20	HOLD & ASSIST R.H.	BD	578	990	990	54	(FIP&FIP)X2	TRIP HEATER	20
21							+½FI+FI	- AVE. 2 TIMES	21

ACTUAL MOTION-TIME ANALYSES of the two operations pictured on these pages. Note that although the operations look very similar, the time required for the longer heater insert is almost 13% larger than the time for the smaller heater



TYPE _____ WORK FACTOR CBS-HYTRON ANALYSIS SHEET (HEATER INSERT) DATE 2-24-55 PAGE ___ OF ___

NO. _____ OPERATION 24 LEG HEATER - OVAL CATHODE PLANT _____ DEPT. _____ ENGINEER _____

NO.	LEFT HAND ELEMENTAL DESCRIPTION	MOTION ANALYSIS	ELEM. TIME	CUMULATIVE TIME		ELEM. TIME	RIGHT HAND MOTION ANALYSIS	RIGHT HAND ELEMENTAL DESCRIPTION	NO.
1	R. TO TRAY OF MOUNTS	VA6D	47	47	60	60	VA6SD CMA T.=.470 R.=.885	M TO FINISHED PARTS TRAY	1
2	SEARCH	VA2D	29	76				ASY. BUTTON TO HOLE IN TRAY	2
3	GR. MOUNT	½FI	8	84		8	½FI	RL. MOUNT	3
4	CLEAR TRAY	A2	20	104		32	VA6	R. TO W.A.	4
5	PALM MOUNT	F2+F2+FI	50	154					5
6	M TO HEATER BOARD	VA6SD	60	214					6
7	GR. HEATER	FIP	23	237					7
8	WITHDRAW FROM BOARD	AI	18	255					8
9	M TO R.H.	VA9SD	74	331	331		BD	WAIT FOR L.H.	9
10	GIVE HEATER TO R.H.	½FI+FIP	31	362	362	31	½FI+FIP	TAKE HEATER FROM L.H.	10
11	PASS HEATER BETWEEN HANDS	1¼ X ½ PASSES	29	391	391	29	1¼ X ½ PASSES	PASS HEATER BETWEEN HANDS	11
12	UNPALM & PP MOUNT	F2+F2+FI	50	441	441	50	BD	WAIT FOR UNPALM MOUNT	12
13					498	57	A2SD	AP. CATHODE WITH HEATER	13
14					606	128	V3AISD+AIP	AL. & INSERT LEGS	14
15					647	41	(REPEAT ½)-25%	R. & INSERT 2ND LEG -25%	15
16					673	26	AIP	UPRIGHT & INSERT HEATER	16
17					699	26	(AIS+AIP)-50%	DISLODGE CRIMPS - 50%	17
18					751	52	(V3AIS+AIP)-50%	DISLODGE FOLDS - 50%	18
19					1042	291	(½FI+AIP&FIP	PUSH HEATER	19
20						—	+AIP)-V3½	- AVE. 3½ TIMES	20
21	HOLD & ASSIST RH	BD	694	1135	1135	93	(FIP&FIP)X1½	TRIP HEATER	21
22							+½FI+FI	- AVE. 1½ TIMES	22

Work-Factor MOTION-TIME TABLE FOR DETAILED ANALYSIS:

1 Time Unit = 0.006 Second.

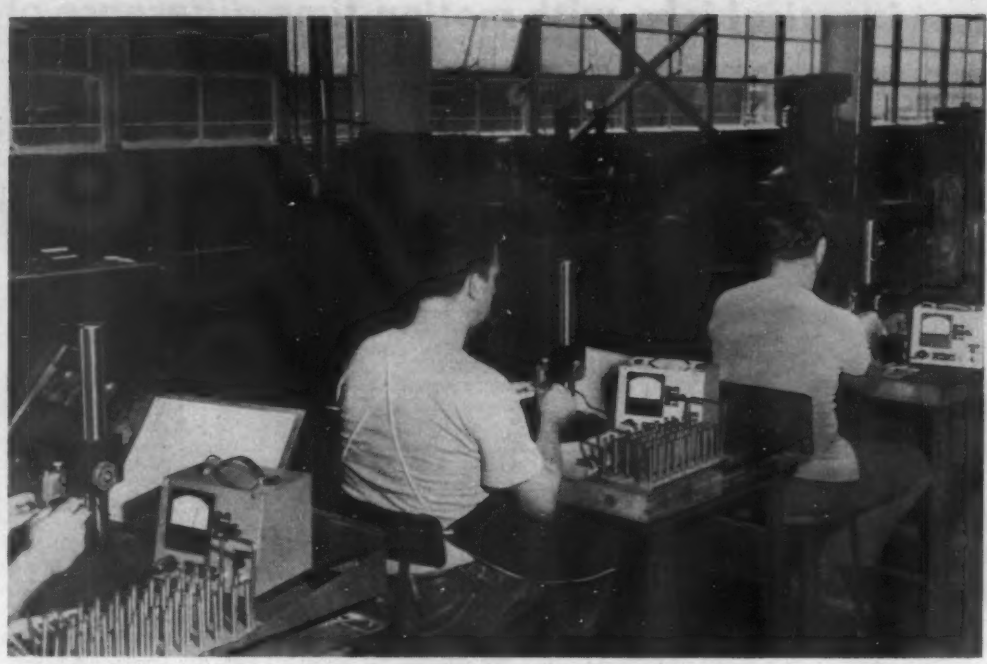
A-1

DISTANCE MOVED	BASIC	WORK FACTORS 1	2	3	4
(A) ARM—Measured at Knuckles					
1"	18	26	34	40	46
2"	20	29	37	44	50
3"	22	32	41	50	57
4"	26	38	48	58	67
5"	29	43	55	65	
6"	32	47	60		
7"	35	51	65		
8"	38			64	73
			60	72	82
			70	84	96
		62	79	95	109
6"	47		87	105	120

A3SD — A6SD — A6D

DISTANCE MOVED	BASIC	WORK FACTORS 1			
(L) LEG					
1"					
2"					
				UP	— —
(F, H) FINGER-HAND—Measured at Finger Tip					
1"		16	23	29	35 40
2"		17	25	32	38 44
3"		19	28	36	43 49
4"		23	33	42	50 58
Weight in Lbs. Male		⅓	2½	4	UP —
Fem.		⅓	1¼	4	UP —

F1P — F1



DIAMETER AND OUT-OF-ROUND are checked within 0.000050-in. tolerance on lapped hydraulic-motor pistons at Sundstrand Machine Tool Co. Gaged on a production basis, with 100% inspection, the operation permits inexperienced workers to be used. Deviations from nominal are shown by a high-speed meter, and the 0.000050-in tolerance corresponds to five graduations on the meter scale—a distance of ⅜ in.

ELECTRONICS: New answer to shop gaging

As modern technology demands ever tighter tolerances, more complex components, and shorter manufacturing time, it also contributes the techniques and equipment to achieve these goals. One such tool, electronics, has until recent years been buried in the laboratory. Now it is time that shop men got better acquainted with this subject and with the wealth of answers it offers. Here are some typical gaging problems solved by electronics. They suggest many other applications

DAVID M GASKILL,
CLEVELAND INSTRUMENT COMPANY,
CLEVELAND, OHIO

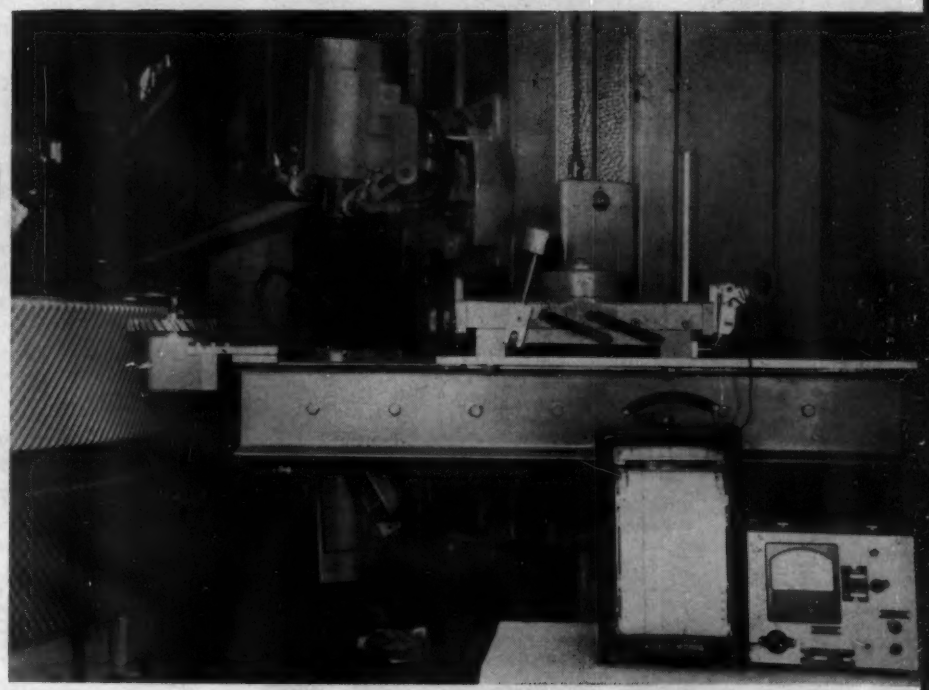
Electronic gages are used to check runout, concentricity, roundness, and taper, in addition to dimensions. They are used in every phase of manufacturing—in the gage room, the toolroom, and in production. In addition, electronic techniques lend themselves to a variety of automatic devices for gaging, sorting and control, and to provide permanent chart records of measurements or conditions. Frequently this equipment permits improvement of an established gaging practice; it sometimes provides a method for gaging where gaging would not otherwise be possible. Speed, sensitivity of measurement, and reliable repeatability are characteristics of this method. Furthermore, it lends itself to remote operation, if necessary, and gage indications can be fed directly into machine tools, as a control function.

An electronic gaging system, basically, consists of (1) a gage head, (2) an electronic amplifier, and (3) an indicating meter. The gage head may contain a transducer, a variable condenser, a rheostat, a magnetic reactor, or any one of a number of other sensing elements. Internally, design of the gage head seldom concerns the shop user. The three components are electrically connected and it is not unusual for the meter or recording instrument to be built into the amplifier case.

An electrical signal proportional to the displacement of the tip that contacts the work is produced by by the gage head. This signal is magnified by the amplifier, and the amount of tip displacement is indicated on the meter in increments of linear meas-

DUAL UNIT checks OD and roundness at two points simultaneously as one of five final-inspection setups on armature shafts at Lamb Electric Co. Two gage heads are used in a special fixture. The two-channel amplifier provides a meter for each diameter checked. Another multiple-gage setup checks four dimensions, two at a time, a fifth dimension individually, and the concentricity of an OD

problems



FORM AND PD ECCENTRICITIES of high-precision gears made at the Medium Steam Turbine, Generator, & Gear Dept, General Electric Co are measured and recorded with electronic gaging equipment. Production gear rolls in contact with a master gear, which is carried on a sliding beam suspended from a saddle on the gear-shaving machine. A pin on the lower slide actuates a gage head mounted on the stationary upper slide. Eccentricity in the production gear causes the beam assembly to move in and out; the amount of movement is shown on the recorder chart

ure, decimal parts of an inch usually, or in any other units desired.

As a result of this electronic sensing and amplification principle, these gages can be made sufficiently sensitive to measure deviations in dimensions as small as 0.000010 in., 0.000001 in., or even 0.0000005 in. Many of these gages will measure far more accurately than is practical when the other physical, mechanical, and atmospheric variables are weighed into the resulting reading. To take full advantage of gage accuracy, the conditions under which the gage is used must be considered too.

However, this equipment is by no means limited to small-tolerance applications. Sensitive gaging is required, even with relatively large tolerances, to detect unfavorable trends based upon machine or process capability, and permit correction *before* the limits are exceeded. Electronic gaging more than

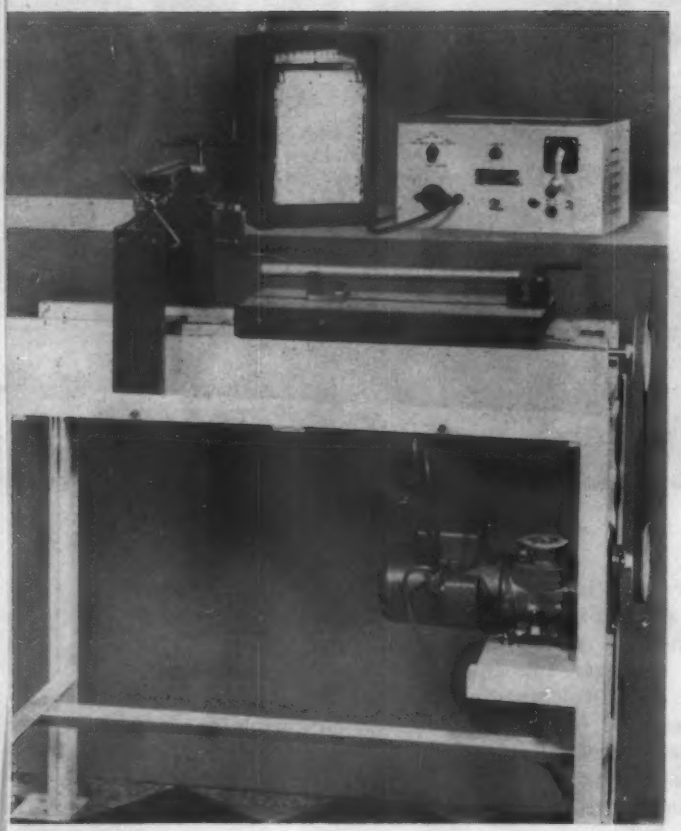
TO CENTER THE OD of a bearing race on a magnetic chuck within 0.000020 in. maximum runout before grinding the ID, Timken Roller Bearing Co uses electronic gaging with a method of work setup, it is said, where no other known method will do the job. First, with the chuck rotating, and at partial holding power, the race is centered by eye. Then it is precisely centered by bringing the tip of the gage head in contact with the OD, then tapping the side of the work until it rotates within tolerance as indicated by the adjacent meter

fills the requirements of many varied applications.

Inherently flexible in application, the gage head, amplifier, and meter each can be used remote from the other two, as desired. For example, the meter and amplifier are commonly used at a distance from the gage head—on a bench or to one side of a machine, wherever most convenient. Similarly, the gage head and meter can be used together at the gaging location, with the amplifier some distance away. In addition, it is possible to provide two meters for each gage head, one at the gaging point and one at a central control station, or a meter and a chart recorder.

Gage heads can be used on standard or special stands, or mounted in gaging fixtures; they can be mounted individually or ganged. As long as an electrical cable can be run from the gage head to the amplifier, heads can be located as otherwise inaccessibly as may be required. Without loss of accuracy, gage heads can be mounted upside-down or in any other position necessary to reach the surface to be gaged. Much of the equipment is small and lightweight; can be carried to the machine with very little effort.

In addition to using the electrical output of the amplifier to operate a recorder, thus provide a pen-drawn chart record, this output also will operate many electrically actuated devices such as relays, Thyratrons, and servomechanisms.



DETERIORATION OF RADIOACTIVE BARS is measured with this remote setup. Equipment consists of a motor-driven work carriage (with a gage head mounted on it above the work), an amplifier with built-in controls for the carriage drive motor, and a recorder. In use, the amplifier and recorder are located in a room separate from the work carriage. Work is loaded on the carriage by mechanical hands (manipulator) and is passed beneath the gage head by the carriage. Similarly, if atmosphere were explosive amplifier would be remotely located to prevent chance of spark explosion

American Machinist SPECIAL REPORT NUMBER 410

HOW TO TOOL WITH *plastics*

GEORGE H DeGROAT, associate editor

Plastic tooling has come a long way in 20 years. In the early stages of development, there was a tendency toward over-enthusiasm; misapplication often led to poor results.

Today, we know better what can be expected of each plastic material and how to apply it best. Plastic dies, jigs, and fixtures for moderate production and experimental tooling have given freedom in product design.

This Special Report outlines the plastics most widely used and new materials now available. It describes the new toolmaking techniques that are being developed. Case studies illustrate current applications of these methods in Metalworking.

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Tool materials have been improved

Biggest advantage of plastic tooling over steel and other metal tools is low cost. Cast plastics, for example, can be poured around plaster, wood, or metal patterns to obtain a duplicate of the pattern surfaces with little or no "barbering" or finishing to size. These tools are made faster than conventional tools, thus saving labor costs—but equally important to many users is the short delivery time that eliminates weeks or months of waiting for delivery of conventional tools. They require no duplicating equipment for producing complex contours; in addition, changes or modifications can be made quickly.

Most important single factor in the successful application of plastics for tooling is the correct choice of materials. Cast plastic materials for tooling cover a wide range. Among those in widest current use are phenolics, ethylcellulose, polyesters and epoxies, ranging in hardness from soft, flexible materials to those that are rigid, hard-surfaced and non-deforming. In general, important considerations to be taken into account when selecting a material for any particular tool include working temperatures, pressures and the production quantities required.

• CAST PHENOLICS

For tools such as stretch and forming dies, pantograph dies, foundry patterns, checking and assembly fixtures, cast phenolic materials are most widely used. These plastics are easily cast and have good high-temperature strength. Although their physical properties are not as great as those of the epoxies, they have a higher heat distortion point (300 F for continuous use, 400 F for short periods), and are said to withstand frictional heat generated by metal-forming operations better than epoxies.

Rigid castings of moderate strength are produced from this thermosetting material and curing is accomplished with heat at about 180 F or at room temperature when the material is acid catalyzed (accelerator type). Method of curing, of course, depends upon the equipment available for mixing, pouring, and curing. In either case, the material cannot be reclaimed after curing. Although room-temperature curing is possible with accelerator-type phenolic resins, it is reported that there is some sacrifice of physical properties and an increased degree of shrinkage caused by the large amounts of accelerator necessary.

Phenolic resins are relatively inexpensive. Because they can be cast to shape accurately and are dimensionally stable, tools require little or no hand finishing. Mixing and casting the resins, catalysts, and fillers is a simple procedure. Moreover, the resulting casting can be worked easily with standard woodworking tools. Light weight is one of the principal features of this material which, together with its hard surface and accuracy of contour, make it advantageous as templets or patterns for Keller, Hydrotel, and other duplicating machines.

In general, phenolic materials are flexible and strong enough to withstand the stresses imposed in such applications as hammer forms, stretch forms, hydroforming and similar dies. Draw dies are also a common application of this material and, although construction varies, are generally made up of a combination of steel or Kirksite with the phenolic in contact with the work. Materials such as 7075 aluminum, ¼-hard stainless, and pure titanium are formed successfully on double-action phenolic draw dies.

• LIMITATIONS OF PHENOLICS

Among the limitations imposed on the phenolic resins in tooling applications is the need to avoid sharp corners, small radii, and unsupported sections that are easily fractured under sharp impact. Castings are relatively brittle and cannot withstand rough handling. Temperatures above 200 F are

Simple, low-cost equipment . . .

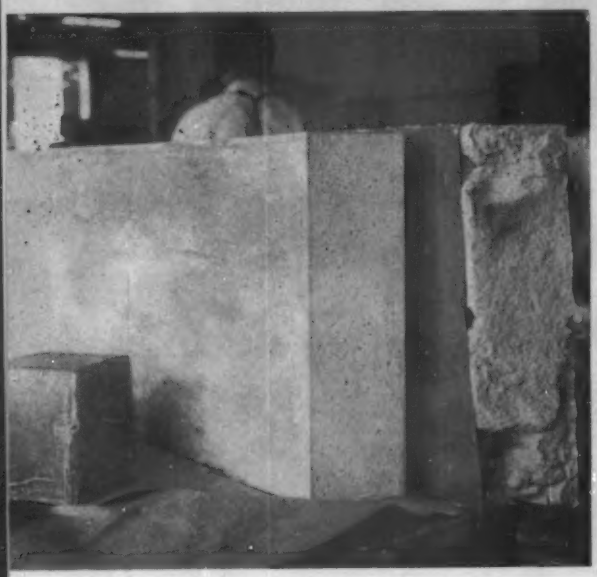
for making tools is one of the main attractions of plastics. Usually, a surface plate, grinder, disk sander, spray gun, straightedges and files, brushes, shears, and other small tools are sufficient. An oven for some applications is also helpful

Removing the release agent . . .

is one of the steps in making a plastic tool. This one, just removed from the pattern, is the upper draw ring for a triple-action die to produce truck floor pans

Plastics are easily machined . . .

and usually require little or none—except for squaring as in this case—or other relatively simple operations. Modifications to plastic tools are quick and easy—permit frequent, inexpensive changes for developing blanks or proving die design

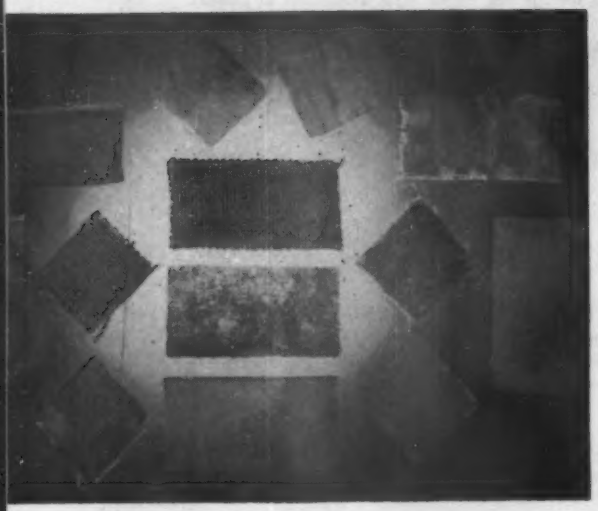


Lightweight reinforcement . . .
of plastic tools is often accomplished with epoxy foam. Excellent bonding is achieved with this material and the metal part of the tool. Here, a welding fixture for positioning stainless-steel aircraft parts is constructed with foam reinforcement. Section at left has been trimmed to size

usually avoided—as is thermal shock—because phenolics have low thermal conductivity.

When tools are stored outside, it is well to permit them to return to room temperature before use. Inserts in the tools should be rounded off to avoid stress points. In general, good tool-design practice should be followed. Shrinkage may be a problem, depending upon the degree of accuracy required, but allowances for this are usually pre-calculated and can be reduced to a relatively low value by using filler materials.

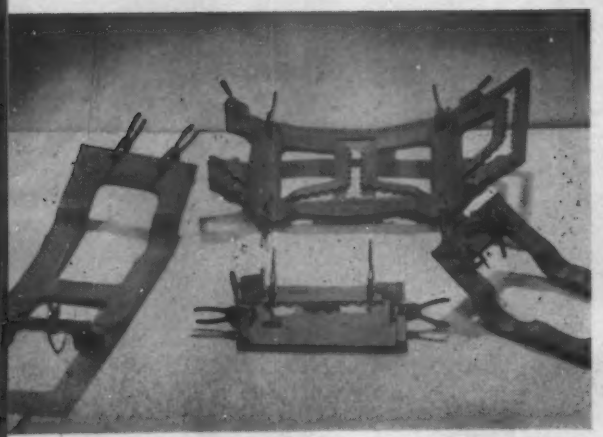
Use of phenolics in low-pressure laminated tooling applications has been held back to some extent by the lack of consistent adhesion between the resin and the glass fibers. A number of different sizing materials have been tried to meet this need, but as yet none have been completely satisfactory. The acid catalyst employed with phenolics will attack unprotected metal and limits fillers to such materials as asbestos.



• EPOXY TOOLING

Most recent of the new additions to plastic tooling materials are the epoxy resins. These thermosetting resins achieve rigid structures with the addition of amine-type hardening agents and are available both

Glass-fiber reinforcement is essential . . .
for strength in many tools. Cloth of woven glass in various weaves and textures is selected on the basis of desired properties such as pliability, weight, breaking strength, thickness, and cost



Epoxy laminating resin and glass cloth . . .
are most frequently used materials for fixtures. These welding fixtures for aircraft panels are light, accurate, and strong—can be built quickly and cheaply

as laminating and casting resins. At present there is a definite trend toward their use for metalworking tools because of their low shrinkage, superior strength, dimensional stability, room-temperature cure characteristics, and high adhesive qualities which facilitate casting inserts into the tools. In addition, a wide range of fillers or additives can be employed with the casting resin to modify its form to achieve specific properties. Among the additives employed are aluminum, silica, vinyl, polyamide, melamine, acrylonitrile and many others. These additives provide a number of desirable properties. Epoxies can be cured, for example, in any length of time by selecting the proper catalyst and can be heat- or room-temperature cured depending upon the application.

Physical properties of epoxy plastics may be varied from soft, rubber-like formulations to hard, rigid, and brittle structures. Naturally, consideration of the tool function must be made before selecting the material to be used because the hardest material is not necessarily the toughest. Often it is necessary to compromise—or even sacrifice one property to achieve another. Such adjustments are entirely practical with epoxy resins. In addition to dimensional stability and toughness combined with low shrinkage, the high adhesive qualities of epoxies make them ideal for applications where bushings or inserts are to be cast in the tool.

Their adhesion to metal and glass is outstanding, and for laminated glass-fiber applications, epoxies are superior to other resins. For wear resistance in tooling they are often used for glass-laminated faces —backed up with cores of cast epoxy, cast phenolic, cast iron, or other materials. They are the most widely used resins for light, laminated jigs and fixtures where dimensional accuracy is essential.

• EPOXIES REQUIRE CARE

As with any other material, good toolmaking practice must be observed in working with epoxies. Cleanliness, for example, is important for good adherence of this material to other surfaces and sand-blasted, zinc-based cores must be free of oil, oxide film, or hand prints. Epoxy surfaces must have adequate supporting structures to prevent distortion.

Unless high-temperature compounded resins are used, temperatures above 200 F are to be avoided at present. One of the main directions in the development of this material has been toward raising heat resistance. By oven-curing the materials, heat distortion points of 300 to 350 F can be achieved and, according to resin suppliers, room-temperature curing resins are now being developed that will withstand temperatures of 350 to 400 F.

Although epoxies cost two or three times more than phenolics, there have been recent reductions in the price of basic resins which are reflected in the prices of formulations from suppliers. It is reported that their cost is now becoming competitive with that of the cheaper phenolics.

Polyester resins, which cost about 75% less than the epoxies, are used for glass-reinforced laminated fixtures where high dimensional accuracy is not critical. These laminating resins are available with resistance to temperatures up to 500 F, but forming pressures must be low and production is limited by low resistance to thermal cycling. Catalyzed with organic peroxides, polyesters form thermosetting materials without byproducts of condensation, as in the phenolic reaction where curing is accomplished by condensation and the liberation of water that often remains in the material after the cure.

Polyesters are the cheapest of the plastic tool resins but have serious limitations as far as certain tool applications are concerned. Volumetric shrinkage averages between 6 and 10%, prohibiting their use for highly accurate tools. Oven curing is a necessity because optimum mechanical properties cannot be obtained at room temperature. Usually curing temperatures run about 200 to 250 F.

They are used mainly in laminated form, and in tools of this type provide good durability and strength. Because they are non-reactive with other materials, metal inserts may be cast into the tools and base plates attached without prior protective treatment.

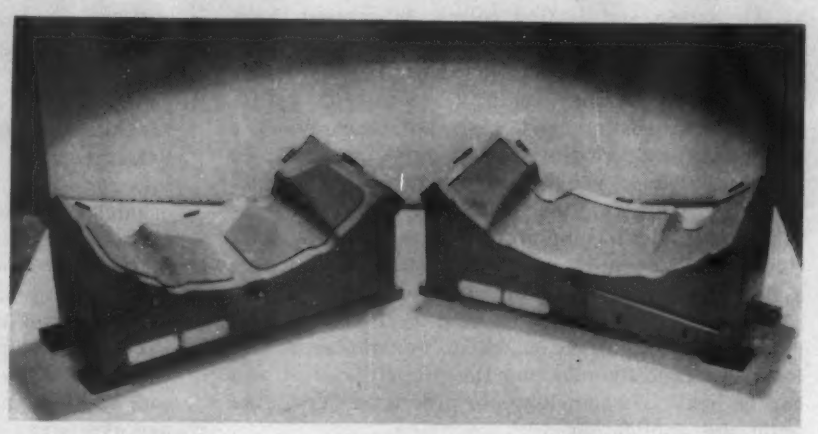
Ethylcellulose has recently been modified to meet the need for resiliency in such tools as drop hammer dies. This is a thermoplastic material (it can be reclaimed after curing by melting the resin) and is compounded for various degrees of hardness and flexibility depending upon the end use of the tool. Main uses to date are for drop-hammer tools, pressure rings for draw dies, and similar tools.

• NEW DEVELOPMENTS

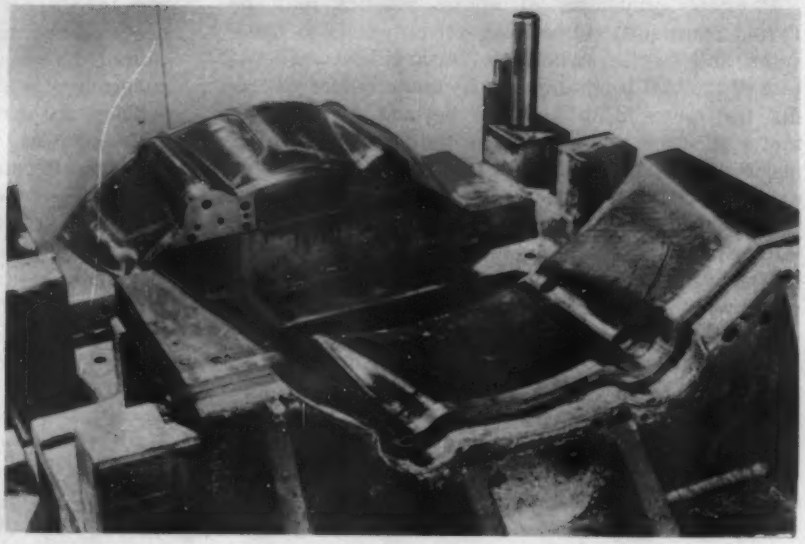
New materials now being developed include a foam epoxy that sets at room temperature; a stable phenolic board that can be planed, drilled, or scraped with ordinary woodworking tools; and troweling and splining resins that will set in one hour and not sag or run out of shape even on vertical surfaces. Others are heat-resistant bonding resins and a metal-filled casting epoxy with heat resistance of 300 F and fair heat conductivity.

Of great importance to Metalworking is the development of harder surfaces for cured epoxy resins. Fillers such as carbide provide a high degree of abrasion resistance at the surface, but the essential hardness of the resin remains the same.

Other needs include high-temperature resins that can produce high-quality laminates with current cold-set laminating techniques. These resins must be capable of retaining adequate working strength in the 200 to 400 F range. As most tool shops now employ cold-set fabrication methods, they are faced with cost problems when heat-cured laminating techniques are required. Additional oven equipment is needed or they must go to vacuum-bag techniques and other methods involving more expense than cold-set techinques.



Epoxy casting resins . . .
are widely used for surfaces over laminating resin and glass cloth layups. This master checking fixture for aircraft panels includes egg-crate base construction as well. A high degree of accuracy in complex contours is obtained and maintained in tools like this



Parting die for aircraft panels . . .
is made of cast iron surfaced with epoxy resins—a resilient resin for the female pad and a harder one for the punch. Steel wear inserts are used at the trim edges

Guessing is gone from

Methods of making plastic tools have advanced in recent years—close tolerances are held as a matter of course, control over the process is sure, and results are predictable. In general, casting materials under gravity feed, laminating under contact pressure, or a combination are now the principal methods of making plastic tools.

Casting is relatively simple and fast; however, laminating considerably increases the strength and toughness of the cured tool. Combining a laminated face with a cast core provides the advantages of both techniques and produces a tool with a strong, tough surface while the large core area is quickly filled with the cast material.

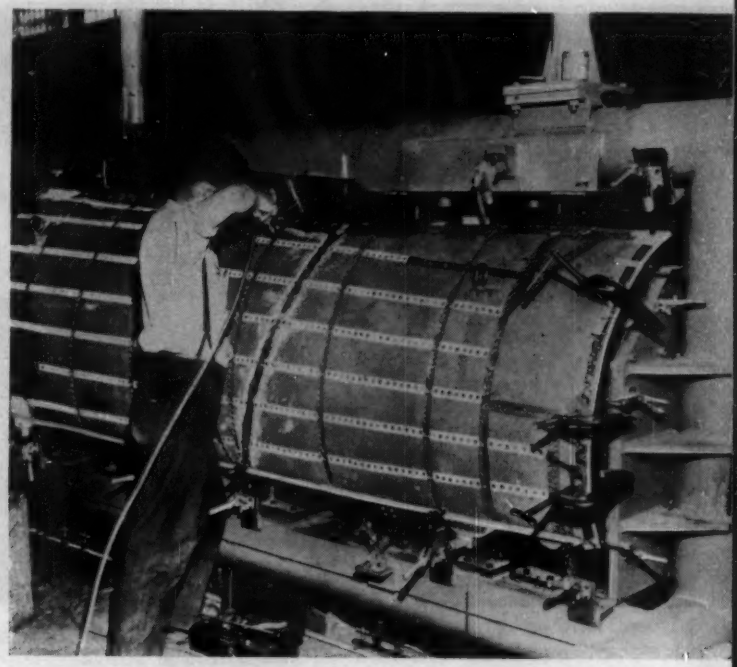
• REINFORCED LAMINATIONS

Comparable to the use of steel reinforcing rods buried in concrete, is the binder-reinforcement technique employed in reinforced laminated tooling. As the name implies, a reinforced plastic is any resin strengthened with glass fibers in the form of mat, weaves, rovings and others. By the use of glass-cloth reinforcement, tensile strength of a resin has been estimated to increase 4 to 8 times and flexural modulus to improve 3 to 5 times. Compressive strength is estimated to be nearly double and impact strength increased from 1 to nearly 20 ft-lb per in. of notch (Izod).

• MOLD IS FIRST STEP

First step in making a plastic tool (either cast or a reinforced lamination), is to make a mold of wood, plaster, plastics, or metal. Often the original pattern is employed by taking a plaster casting, or "splash," from the pattern to form the mold. Casting plaster is the cheapest material from which to make a

About 2500 drill bushings . . .
are inserted in this drill jig for aircraft panels. Strong, lightweight construction is epoxy resin and glass-cloth laminations



Phenolic forming die . . .
shapes acrylic-plastic aircraft canopies without touching this optically clear material. Hot acrylic sheet, (about 340 F) is manually draped in place until the spider overhead clamps the edges. A vacuum circuit in the tool then pulls the sheet into the desired shape with no possibility of marring the optically critical surface. About 25 min. is required before the material cools and hardens sufficiently for removal

toolmaking

mold—especially when only one tool is to be made. When several identical tools are to be made, a plastic mold that can be used repeatedly is more economical.

A clean model, made to the degree of accuracy required in the tool, is essential. Usually, imperfections in the surface are filled with industrial modeling clay or hard pattern makers' wax followed by spraying the prepared surface with a clear lacquer. When the model is to be used to make a die, contour dimensions are taken at the inside of the metal to be formed. For punches or tools that mate with the die but at the outside of the metal to be formed, allowance is made for sheet-metal thickness. This is often handled by fitting sheet wax, warmed for pliability, to the surface of the model. All joints are filled with wax or fused by applications of gasoline.

Cardboard, glass fiber, or plywood dams are placed along the sides of the model to contain the layup to be made. Glass fiber dams are very durable and are used when several layups of the same model are to be constructed. Cardboard is practical and inexpensive when only one layup is needed—and plywood, or pine, is used in cases where a high degree of accuracy is necessary.

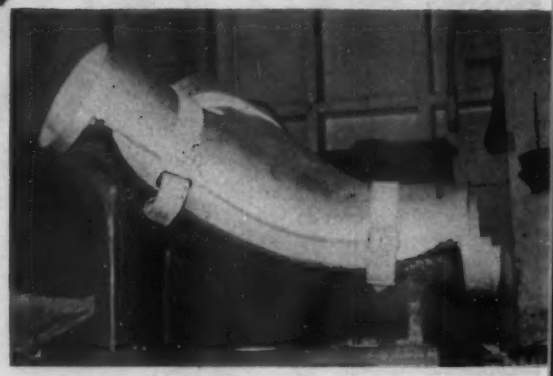
• EQUIPMENT IS "BRUSH AND GLOVES"

After preparing a model for a reinforced laminated tool, a coat of paste wax is applied to the working surface to seal all pin holes or any other small defects. The surface of any laminate can only be as good as the surface on which it is made. This is followed by applications of polyvinyl film which serve as a parting agent, and finally, when the film is dry, another coat of wax.

A thin coat of catalyzed resin is then brushed onto

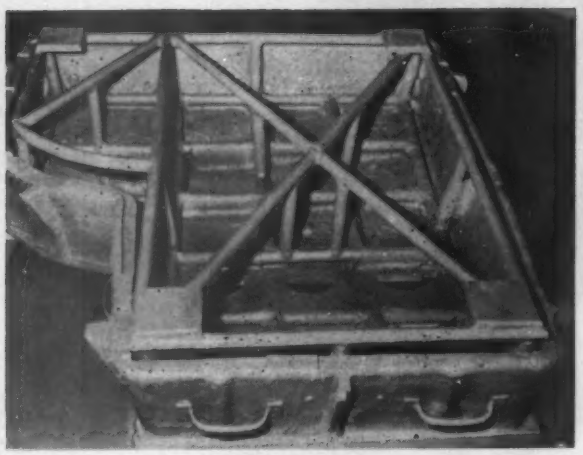
Hot plastic sheet . . .

is formed in glass-cloth reinforced cast-phenolic dies when finished shape is simpler than that required for canopies. Here, pre-cut acrylic sheets are transferred from an oven and clamped in the dies until the form desired is set. Soft flannel protects the dies from dust and prevents marking of the sheet material



Cutoff fixtures . . .

for aircraft ducts and tubing are made with laminated epoxy angles to form reinforcement for an epoxy shell. Finished part was used as a model for making the shell. Masonite base serves as a guide for bandsaw trimming the ducts



Steel base, for rigidity . . .

is used in this inner door spotting fixture shown upside down. Normalized welded steel tubing is combined with laminating resin and glass cloth for strength and light weight

Hot-forming magnesium . . .

is accomplished in this plastic stretch-form die. Surface temperature of the tool prior to stretching operation is 400 F—produced by Calrod units. Magnesium sheet is shown ready for location in press jaws

the mold face to prevent the glass cloth from coming through the face of the finished tool. This coating is usually allowed to jell partially into a gummy state while air bubbles are eased out of it with a brush. Various types of surface coatings are employed for different tools to meet the needs of hardness, resilience, or abrasion resistance. When the surface coat has reached the partially jelled state one ply of glass-fiber cloth is pressed firmly into position on the mold surface. Care is taken not to damage the resin surface because the condition of the face coat and the first ply of glass cloth control the quality of the tool surface. It must be closely reinforced but not broken.

When the surface resin has jelled, and another batch of resin and hardener has been mixed together, the dry side of the glass cloth is impregnated with enough resin to just wet the fabric. From here on laminating proceeds rapidly, with each successive ply positioned and impregnated with a minimum amount of resin. Brushworking eliminates air bubbles as the work proceeds and a paste of chopped glass fiber is applied at deep corners and in recesses for reinforcement where the glass cloth cannot reach.

The laminate is removed from the mold anywhere from 6 to 18 hours after completion—depending upon its size and the curing time required. If the tool is to be subjected to elevated temperatures in use, a heat treat is applied. The technique outlined here is used in about 80% of reinforced-plastic tooling applications where "toolmaker's" equipment consists mainly of a "brush and a pair of gloves."

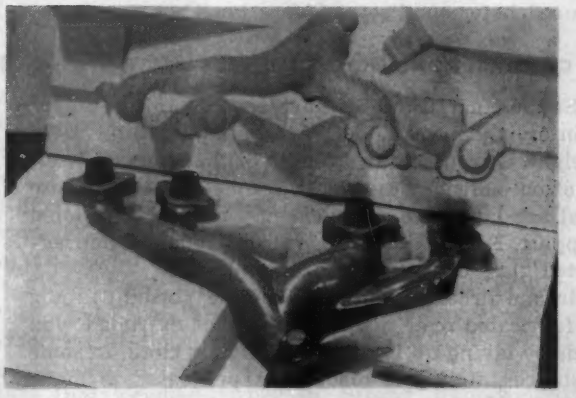
● CASTING IS SIMPLE

Casting tools with epoxies, phenolics, and ethylcellulose is a relatively simple matter. Depending upon the requirements of the tool being made, castings are of either the open or closed type. A wooden build-up around the mold (made in much the same manner as molds previously described), is suitable for containing the casting resin in the open type. Of course, the mold should be level and a parting compound applied to all surfaces exposed to the resin. For closed casting, a flask is built up over the mold and contains gates and risers to insure proper filling.

Curing depends largely on the cross-section of the casting and on the heat-transfer characteristics of the mold. Usually castings of 100 lb or less, total plastic weight, require 12- to 16-hr curing time. Castings over 100 lb require 16 to 24 hr—with the best dimensional control being obtained with a 24-hr cure. Too short a curing period produces unstable castings, while too much heat causes porousness.

Final step is to remove the casting from the mold and clean it. Flash and other irregularities are removed with hand files or grinding disks. Wet sanding removes all surface irregularities before the casting is buffed and polished and when machining is required, conventional shop equipment is employed with high speeds and light cuts.

Usually, cast tools are contained in a metal weldment because large, unsupported castings are relatively brittle and are consequently subject to fracture and cracking. Metal inserts are employed as reinforcement for thin sections or small radii. Such inserts are often set in the tool as it is poured, or



Three-D templet . . .
for Keller machine is made of phenolic resin cast directly from a mahogany pattern. Core of this tool is phenolic foam material to cut costs in filling large volumes

Automotive applications . . .
of plastic tooling include their use for producing the entire line of trucks built by one manufacturer. Here the face of a plastic die for forming truck hoods is checked and spotted. Tool is used in a 600-ton press at 20,000-psi pressure

Cast iron . . .
is the basis of this draw die for auto roof panels, but epoxy casting resin is used to surface the face. Result is a strong, rigid tool with good life. Cost is far below that of a conventional steel die and delivery time much shorter

added after casting by drilling out the plastic and bonding the insert with fresh plastic. In most cases, inserts are designed to lock mechanically with the plastic. In cast-phenolic tools, metal inserts are coated with a protective material to prevent acid catalysts from attacking the metal.

• COMBINED TECHNIQUES

One of the most widely used constructions today is the laminated face backed up by a suitable core material. Epoxy laminates with epoxy-gel surface coats and paper-honeycomb or plastic-concrete cores have been successfully employed in the aircraft industry for Keller machine patterns. Great resistance of the filled surface coat to chipping or penetration by the stylus at sharp corners and resistance of the lamination to impact have increased duplicating accuracy considerably.

Core materials range from foamed phenolic with a compressive strength around 500 psi through filled casting resins to concrete and cast iron. Variables to be considered in selecting a core material include the tool function, operating pressures, temperatures, weight, and cost.

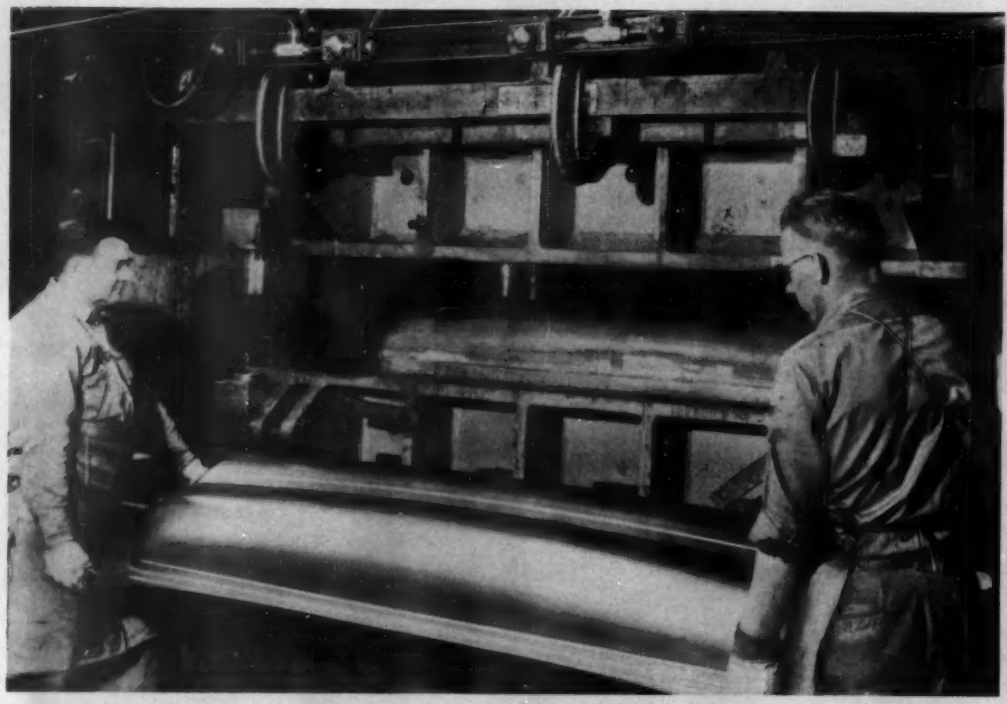
One of the current techniques in combining reinforced laminations with a cast core, is to form the epoxy area last to gain advantage of its adhesive properties. In applying a laminated epoxy face to a foamed phenolic core, for example, the laminate is laid up in the mold in the manner previously described. The core is formed separately to undersize dimensions and after curing is fitted into the mold over the cured laminate. An epoxy resin is then poured between the two for a bond.

• CONSTRUCTION REINFORCEMENTS

Supporting structures have been found useful for reinforcing plastic tools while maintaining light weight. Of course, the strength of the laminate itself is often sufficient for small, simple, tools but those that are large and complex may require additional support. For this purpose, various types of impregnated glass cloth tubing are employed.

In one aircraft plant, for example, straight tubing is fabricated over mandrels made of extruded wax rods by laying up laminations of glass cloth. In some instances, tubing is made of paper-based phenolic or epoxy resins and, for contoured reinforcements, unexpanded paper honeycombs are successful. In the latter case the required profile of the mandrel is cut in the unexpanded material on a bandsaw, after which the honeycomb is expanded, tack bonded into position with cold-set resins, and then laminations built up over it.

Steel or cast-iron structures are employed where maximum rigidity is needed and Masonite, Formica, and similar materials are found useful for egg-crate types of supporting structures.



Steel inserts . . .
are provided in the restrike die for auto roof panels. Here too, basic tool is cast iron surfaced with an epoxy casting resin. Hold-down pad is surfaced with a resilient epoxy resin

Typical tooling today

One of the biggest users of plastic tooling is the aircraft industry—where considerable effort has been spent to cut tool costs and to speed tool-delivery time. In switching to cast-plastic tools from wood or plaster for 3-dimensional patterns used in Kellering at one aircraft plant, 500 hours of hand work were eliminated. The plastic castings were made in 30 man-hours.

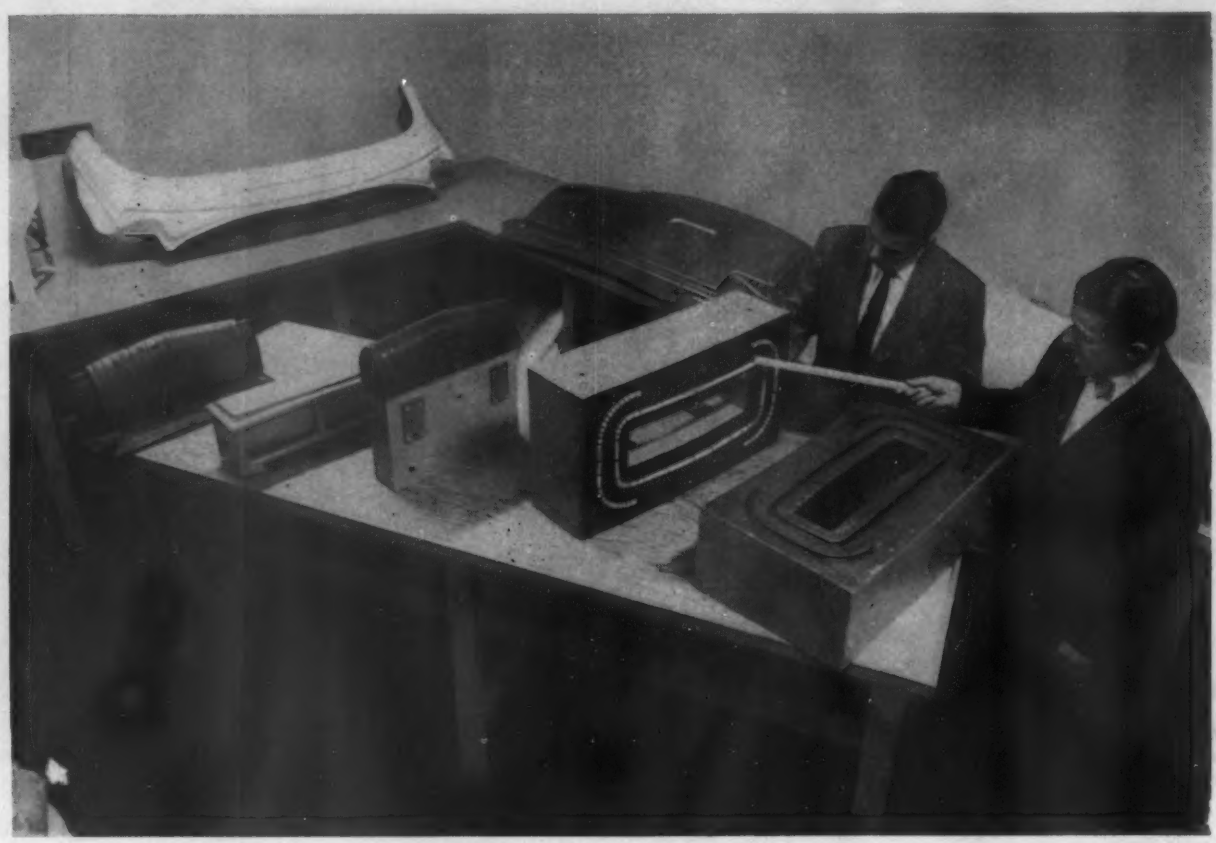
Another advantage gained by plastic tooling in this plant is in the use of plastic tubing as a reinforcement structure. Weighing 1750 lb, a tool so constructed replaced one with a welded-iron structure that weighed 10,000 lb. Strong, light-weight plastic molds of tools are shipped to branch plants and sub-contractors for checking fixtures and for making additional new tools. Formerly plaster molds were used for this purpose but they were fragile and were often damaged in shipment. Plastics take the beating.

• HOT-FORMING MAGNESIUM

Another plane builder has developed plastic tooling for hot-forming magnesium in stretch presses. The stretch form die is made up of a circular steel reinforcing member and a steel base. Between them is a high-temperature cement secured by means of metal lath and the tool face is pre-impregnated glass cloth and resin. A heavy gel coat is necessary in this case to prevent the cloth laminate from pressing a pattern into the magnesium at the forming temperature. The plastic was vacuum-bag cured to a thickness of 3/16 in. using a plaster shell made to the desired outside contour. Calrod units supply heat to the outside surface of the tool for a forming temperature of 400 F.

• PLASTIC ON PLASTIC

Plastic parts are made in plastic dies at another aircraft plant where plaster and phenolic tools are used extensively to form transparent acrylic windows, landing light covers, canopies, astrodomes, and other parts. Several of these tools actually shape the optically clear acrylic sheet without touching it. (For alternate method utilizing vacuum, as done at Douglas Aircraft—Santa Monica, see "Canopy craft forms optical laminates," p 151).



Typical stages in construction . . .
of triple-action automative draw die are shown here from left to right. First, wooden pattern used to layup glass cloth and epoxy resin mold, second. Third, punch contour is cast in the mold—has glass-fiber and resin layup behind resulting shell. Fourth, binder ring is made from die, at far right, a glass-fiber and resin layup—same as mold

In these operations the hot, pre-cut acrylic sheet is removed from an oven and manually draped over the forming tool—primarily an open box-like frame in which the material is suspended. An overhead "spider" clamps the edges of the sheet while a vacuum circuit in the tool pulls it into the desired shape—holding it in position until it cools and hardens. In this way optically critical surfaces are untouched—eliminating all possibility for mars, dents, blemishes, or other defects.

A great many plastic trim jigs (combined with metal) are used in this plant to advantage—especially when contours must be changed to suit product design modifications. Cast-phenolic dies are widely employed for making production runs of glass-fiber parts. Low-cost temporary tooling, made of thin-shelled cast phenolics, is essential to prove the practicality of new part designs and for experimental runs.

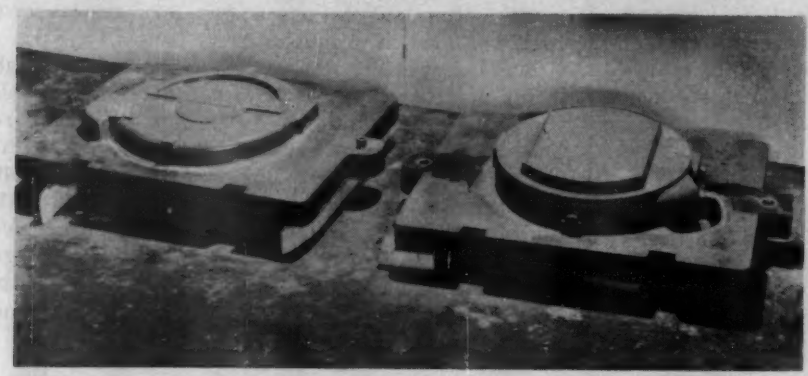
• AUTOMOTIVE APPLICATIONS

Automobile manufacturers represent another big user of plastic tools—not only for temporary and experimental setups but for moderately long-run production too. One builder produced 40% of an entire run of hard-top models on plastic tools reinforced with metal. In this case, the manufacturer got a new, different looking model for about $500,000—in much shorter time than it could have been produced with more expensive conventional tools.

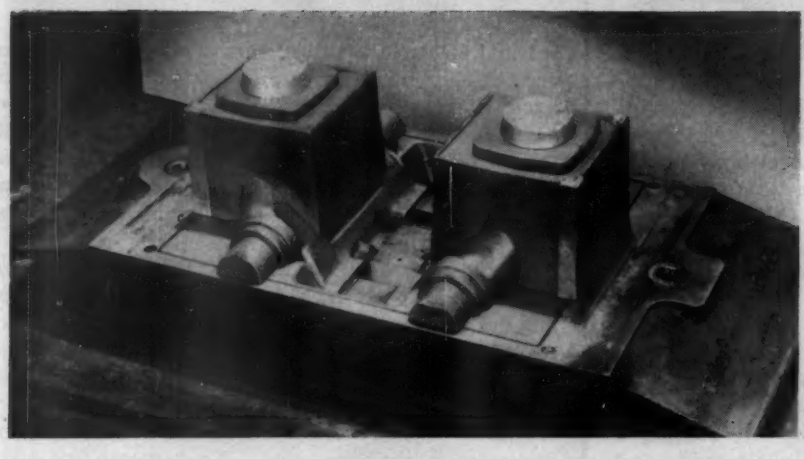
The time advantage here was more important than the lower cost—fast delivery of the tools permitted more time for styling and refining the design of the car. Future plans of this firm include even wider use of plastic tooling to permit more experimenting in the risky area of advanced styling. Basic parts of the car can be made with conventional tools—the cost being absorbed over the whole line—with distinctive features being handled by low-cost plastic tooling.

Another car builder developed prototypes of an entire line with tools made in his own model shop—an area of only 2000 sq ft—and without special equipment. In addition, he built tools for producing parts and panels for other cars.

Cast phenolics were found to be flexible and strong enough to withstand stresses imposed on hammer forms, stretch forms, and short-run hydroform and draw dies. Phenolic foam reduced the



Plastic cope and drag . . .
patterns for a flywheel housing are typical of foundry applications of plastics for tooling. Cast-iron bolster plates are built up with an epoxy core resin and a casting resin on the surfaces



More than 45,000 castings . . .
have been made with this pattern in continuous production for 1½ years. Used on a jolt-squeeze machine, the tool is made with an epoxy-resin core surfaced with epoxy casting material

weight of tools and—in conserving material—added to cost savings.

A newly developed high-strength phenolic resin for room temperature cure eliminated the need for recasting surfaces with epoxy. While this resin had less stability than oven-cured phenolics, it was suitable for its application to tools intended to serve their purpose inside six to eight weeks. A more stable resin was used for duplicate models and check blocks.

Where high impact strength and exceptionally light weight were required for large checking fixtures and duplicate models, epoxy and polyester resins with glass cloth lay-ups were employed. Cast epoxy surfacing was used only when higher physical properties than those of the phenolic materials were needed—as when sharp radii were included in the contour of a hammer form.

• TOOLMAKING IS FAST, SIMPLE

General methods for making tools for prototype cars follow current practice—in that the contour of each part to be made is first established in clay—or by means of mahogany models. For emergencies, quick pine models are built. A model for making a fender, for example, has been fabricated from pine by three men in four days to establish all the requisite physical dimensions.

Once the contour is established, a mold for the plastic is made from the model, using a laminated skin of epoxy reinforced with sisal-hemp impregnated plastic. These molds are sealed with moisture-resistant lacquer, with wax as the release agent.

To construct a hammer form or hydroform block, the sides of the mold are built up with a wooden frame and a low-cost phenolic resin mixed with a hardener poured into it. After setting overnight at room temperature, the casting is removed from the mold and put to work forming sheet-metal body panels in an 8000-ton press. When high strength is required for sharp contours, the phenolic tool is raised ⅛ to ¼ in. from the mold and a surfacing of epoxy poured into the resulting space to bond with the phenolic backing. When only a small area of the tool has a critical contour, the phenolic is chipped back at the critical point, the tool replaced in the mold, and epoxy poured into the resulting gap.

Phenolic foam reduces the amount of material needed for large tools. In such cases a rough pine

templet, or frame, is suspended in the mold and foam phenolic (previously cast and cut roughly to shape) suspended to take up space. This is suspended about 1½ in. from the mold after which liquid phenolic casting resin is poured in to bond the frame and foam core—and furnish a working space about 1½ in. thick.

The resin is poured short of the top of the pine frame set above the mold and leveled. This frame then acts as a base when the tool hardens. Resulting tools are sufficiently accurate to make prototype steel panels checked against templets. They are discarded before they become inaccurate.

• RUSH SCHEDULES AND HIGH PRODUCTION

Plastic tools are of considerable advantage in meeting rush schedules. In one instance, a hydroform block was poured and cured overnight with heat lamps—and 120 urgently needed panels formed the next day. In another instance steel body panels were hammered out on phenolic tools to produce a complete car in 30 days.

No steel dies were used at all to stamp major body parts for a line of 1954 trucks—and all the body stampings for a 1955 luxury car were made on plastic dies. It is expected that more and more plastic tools will be employed exclusively to make various models of cars that are produced in moderate quantities. Moreover, being good now for runs of 20,000 parts—and with improved life coming—it is not unlikely these tools will find more and more applications in high-volume production.

• IMPROVED MATERIALS

Another automotive plant, specializing in bodies, makes good use of plastic tooling made of a material that remains stable for long periods. This is a low-cost, self-curing, epoxy core resin with higher physical properties than those of the phenolic resins and with a shrinkage factor so low it can be ignored. This resin is handled in much the same manner as phenolic casting materials and is frequently used with a low-cost foam core for stretch dies and similar tools. Heat cured at 200 F overnight, it has a compressive strength of 20,000 psi.

About $250,000 have been saved by one of the large car builders in proving die designs alone because alterations in plastic dies are easy to make—and eliminate scrapping metal tools previously used for this purpose. Plastic dies can be altered four or five times in a week. When approved panels are made, the final die contours are employed to make the metal production die.

This company uses dies made with an abrasive-resistant, resin-surface casting on a plastic or metal core. The material has been found to have excellent wearability—but shear and impact strength for corners is not high enough for heavy-gage work. By thinning this resin and laminating it ¼ to ½ in. inside a mold from a die model, and then filling the cavity with a low-cost core epoxy, good results have been obtained in producing steel panels.

For heavy-gage work, a core resin with high compressive strength is now being tested by this company. This material requires a short heat cure and should provide a method of casting dies without a laminate for short runs on steel 0.030 to 0.040 in. thick. At present the best available materials permit forming crs up to 0.090 in. thick and drawing 0.060 in. CRS for a few pieces to prove die design and blank development. Stainless steel up to 0.030 in. thick is currently being formed successfully and so is aluminum up to 0.080 in.

• TOOL LIFE

Die life varies with the material being formed and the characteristics of the operation. Some plastic dwarf dies have been reported to turn out 20,000 steel parts while others produce under 5,000. Life of tools for forming plastics depend on operating temperatures and pressures. One manufacturer reports production of plastic parts on plastic dies as being less than 500 to 1000 pieces.

Plastic tools are also widely used in foundry applications for patterns, core boxes, matchplates, cope and drag plates, and others. Both phenolic and epoxy resins are employed for this work with excellent results, including considerable reduction in toolmaking and maintenance time. These materials are resistant to sand abrasion and are not affected by moisture in molding sands. The smooth, polished surfaces of these cast tools facilitate their withdrawal, reducing the possibility of damage to the mold.

In one core-box application, over 50,000 plaster cores were produced in a plastic box with no sign of wear or deterioration. Core boxes previously made of dental stone lost dimensional accuracy after producing about 1500 cores.

Acknowledgments

We gratefully acknowledge the assistance of the following companies in the preparation of this report:

Kish Industries, Inc
Lansing, Mich.

North American Aviation, Inc.
Columbus, Ohio

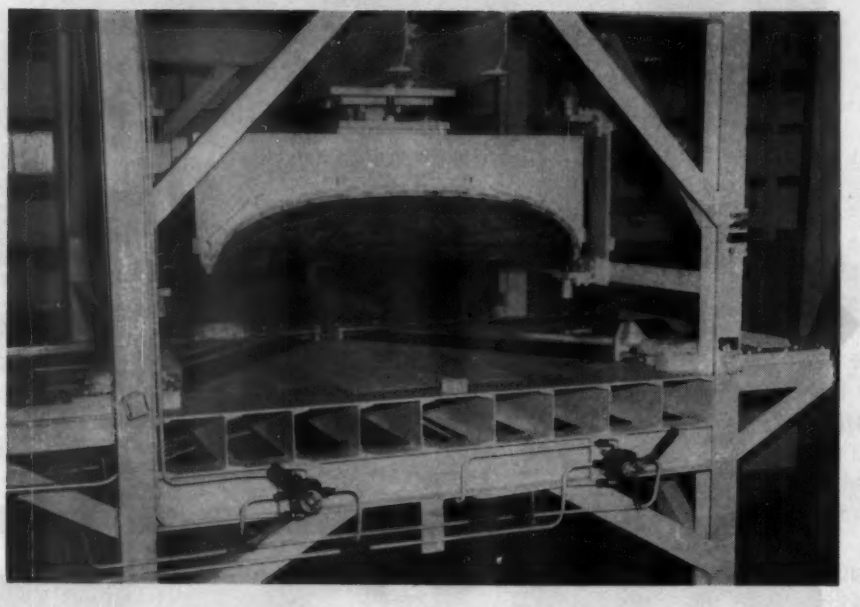
Chrysler Corporation
Detroit, Mich.

Studebaker-Packard Corporation
Detroit, Mich.

The Marblette Corporation
Detroit, Mich.

Convair Div., General Dynamics Corp.
San Diego, Calif.

THIS IS THE FINAL, FORMED PLASTIC CANOPY for the RB-66. Optics are checked by photographing each unit in a jig in front of grid pattern. Camera is located approximately at point where pilot's eyes will be in plane. Three-hole mask used with camera emphasizes distortion by producing multiple grid lines on film if canopy is wavy



FORMING PRESS HAS DIE HUNG OVER FLAT BED on which warmed blank will be laid. Blank is wrapped in muslin to prevent marking and heated for two hr at 300F, with thermocouples on blank and in oven for control. Blank is then brought to press, allowed to cool for 1½ min, then bowing starts. Side-acting hydraulic cylinders squeeze flat arms together, pressing blank edges, and making blank bow upward in middle

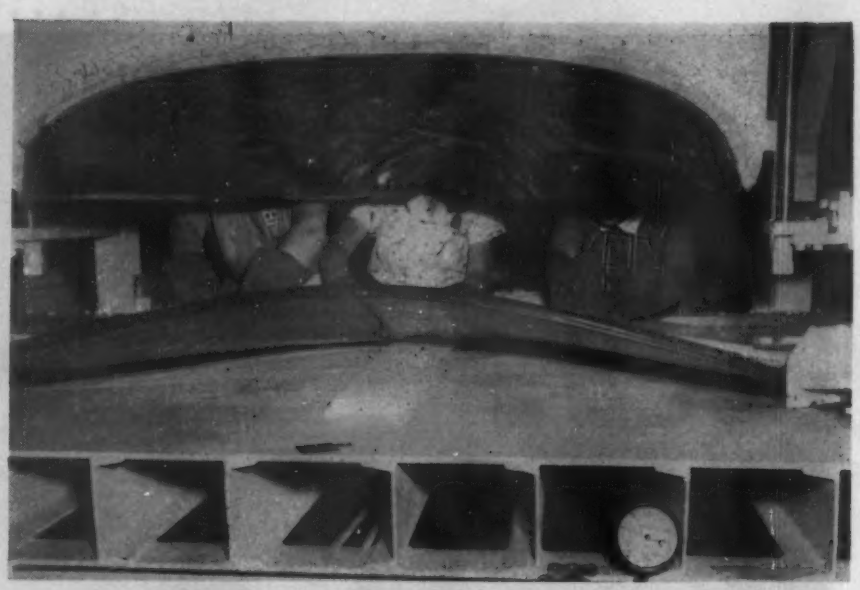
Canopy craft forms optical laminates

One of the most difficult of forming operations is shaping laminated plastics to the curves required for aircraft canopies without ruining optical properties. Here is how Douglas makes RB-66 canopies; a joint development of Douglas departments and Sierracin Corp, Burbank, Calif

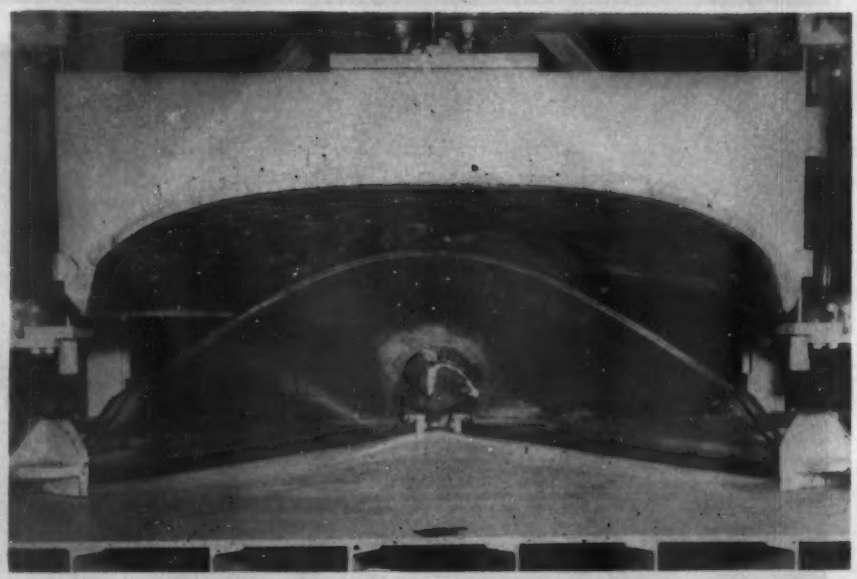
K W TAUBERT, asst supt of plastics,
DOUGLAS AIRCRAFT CO, SANTA MONICA, CALIF

Originally, the RB-66 canopy had two plastic parts mated at a 2-in.-wide joint. This stretched over the pilot's head, restricting vision. The main problem in forming the canopy in one piece was distortion, caused by the fact that the sandwich construction of the blank would allow the soft inner layer to flow unevenly. But the method illustrated was developed in the laboratory, then applied in production, to form the plastic without excessive distortion. The present one-piece canopy is bullet-shatter-resistant and holds pressurization inside the pilot's cockpit.

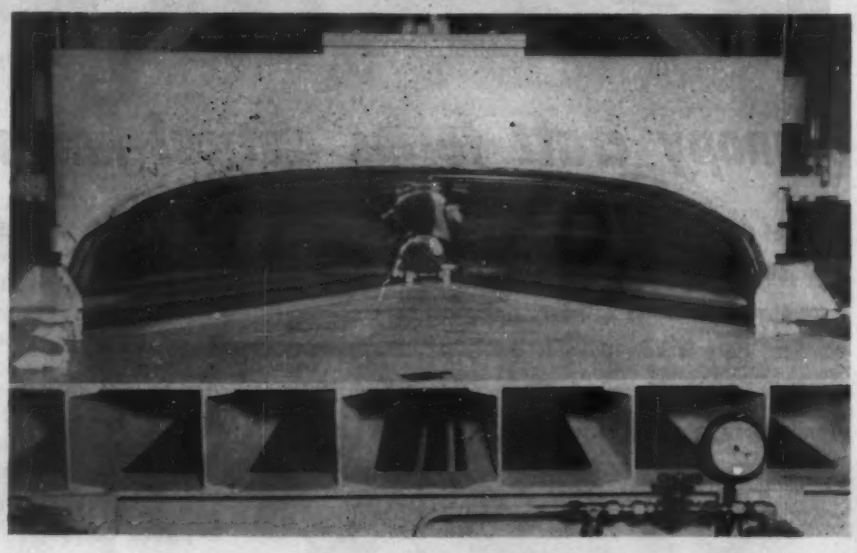
PLEASE TURN PAGE ▶



CANOPY MOVES UP IN CENTER because of flannel pad on table, which introduces initial bow. Plastic is wiped with cold-water compresses during entire forming cycle. Bottom layer of polyester and inner soft-vinyl layer are cut back on edges so laminations will slide on each other, ending up with edges flush when forming is complete. Inner polyester layer is 0.225 in. thick



EDGE-FORCING ARMS ADVANCE TO PRESET STOPS in 7-9 min, making plastic laminate form upward evenly. Spots on die surface are dabs of grease that will flatten out as canopy assumes die shape; thus indicating complete plastic-to-die contact. Smaller radius at rear is being cooled continuously with soaked cloths because it is most critical section



DIE IS LOWERED ONTO BOWED LAMINATE to force it to required contour. This takes about 50 sec. Note flattened-out grease blobs. Die face is covered with a layer of ¼-in. rubber to prevent scratching. All exposed parts of canopy are now covered with muslin cloth to prevent sudden or uneven cooling, and canopy is left in die until cool enough for removal

Round Table

Just One Big Happy Family

"You sure got Harrison riled up last night at the foremen's meeting, Al. You trying to get yourself fired?"

"Not particularly, Ed; but I'm getting tired of this creeping company paternalism. The company just gets bigger and bigger, and they keep treating us more and more like feeble-minded children. I wish they'd drop these foremen's meetings altogether."

"I think you're suffering from experience pains, Al. After all, there are a lot of foremen younger than you—and even greener, if possible. You've probably picked up a lot of things that are new to them."

"Not this phony enthusiasm that Harrison was trying to sell last night, Ed. If they want us to play games, then the hoopla's OK. But running a department takes a lot more than good spirits. I wonder if Harrison's ever thought of trying to get across a few good basic ideas, instead of filling us full of baloney."

"That's one of the natural troubles when a company gets big, Al. Management wants the foremen to be energetic and all for the company. That's why Harrison carries on like that once in a while. Why don't you just ignore it and try to get some good out of the meeting? There's plenty besides Harrison's little talks."

"Instead of selling us on what a grand place this is to work, they ought to try tackling some of the really tough personnel problems we have, for instance."

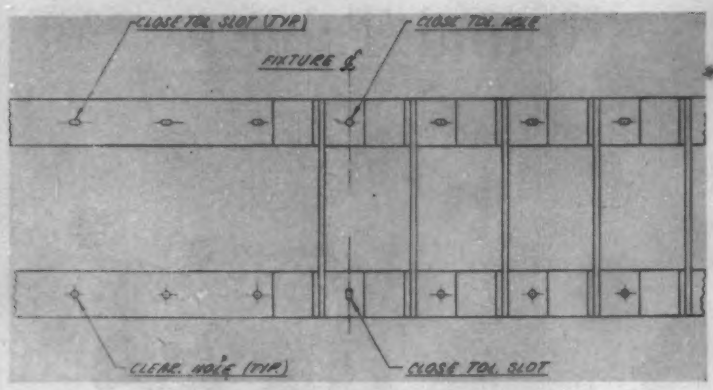
"They want the foremen to pass along that enthusiasm to the workers, Al. After all, if you're sour on the company, you'll make your men sour, too."

"I'm not sour, Ed. I just think we have plenty of serious things to cover in a foremen's meeting. They don't have to get us all worked up about the benefits of working here."

"That's just so you'll know them so well you can spout them to your men, Al."

Do some companies overdo the "team" idea? Does this approach often turn against company management? Your ideas on the subject may help others with this problem. Discussions of earlier topics start on page 244.

MASTER TOOL, 12 ft long, for drilling attach holes for four doors on bottom of plane, requires close tolerances so doors will be interchangeable. This requires magnesium tooling plate to match aluminum's expansion rate. Magnesium is anchored to steel base



with elongated locating holes to permit expansion from center. Round holes fit on smaller pins that permit expansion in any direction; shoulder screws prevent warping

Magnesium plate aids aircraft tooling

Light weight, an expansion coefficient close to aluminum, machinability, and cost combine to make magnesium plate a new and useful tooling material for jigs and fixtures

THOR H BAHRMAN, tool design engineer, REPUBLIC AVIATION CORPORATION, FARMINGDALE, LI, NY

Even with the lightest of steels it is impossible to build enough rigidity into aircraft tooling and still keep it light enough to be handled manually. This has led Republic Aviation to turn to magnesium.

Five primary considerations that led to the selection of magnesium were:

1 . . Weight. With magnesium weighing about two-thirds as much as aluminum and less than one-fourth as much as steel, tools can be built within weight limitations and still maintain rigidity.

2 . . Machinability. Heavier depths of cut and higher rates of speed are possible than with other metals. It can be sanded with disk or band sanders with accumulators to collect and deposit the dust particles in oil. When fine cuts are taken above 600 sfpm, mineral oil coolants are necessary.

3 . . Weldability. Magnesium can be readily welded by shielded-arc methods. Weld efficiency of the joints for AZ31 magnesium is 95%, compared with 64% for 6061-T6 aluminum. Warping can be corrected by clamping the assembly to a steel beam and heat treating at 350 F for 1 hr (which stress relieves the joints at the same time).

4 . . Coefficient of expansion. Thermal expansion rate for magnesium is 0.000014 per °F, compared with 0.000013 for aluminum, and 0.000006 for steel.

5 . . Cost. Because the metal is used on a volume rather than weight basis for tooling, it costs less per part than aluminum, though more than steel or non-metallic materials.

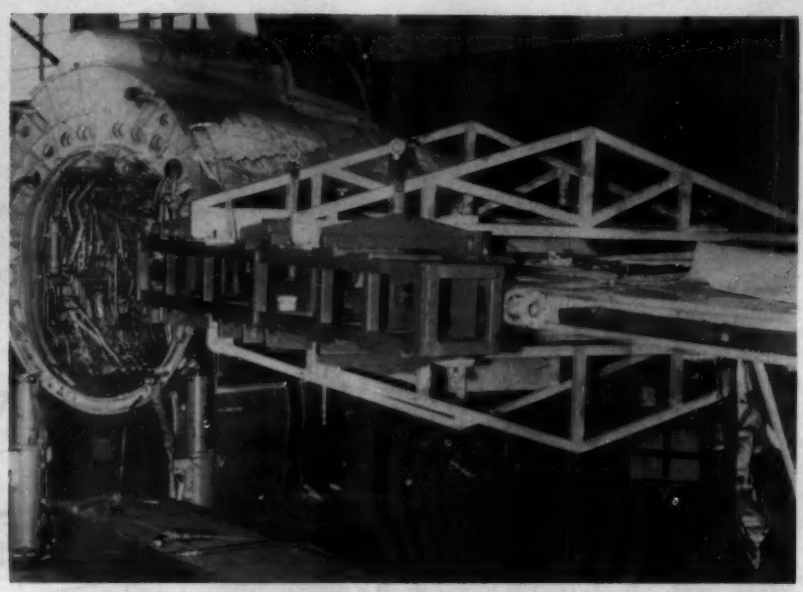
In the fixture illustrated above, attach holes for doors must be held to 0.001-in. tolerance. If the holes were drilled in the plane in a steel fixture at 85° and and in the doors at 70°, the size change over a 100 in. distance would be 0.009 in. in the fixture and 0.021 in. in the aluminum plane. This would make it impossible to hold the tolerances required

The actual fixture was made with a steel base and the magnesium attached to it with elongated holes to permit expansion and contraction from the center between the steel and magnesium. The only alternative would be a controlled temperature area. This is impractical in an aircraft plant where doors must be opened frequently to move planes in or out.

Many fixtures are made of three tubes welded together. It makes a light, sturdy construction and any two of the three tubes make a flat surface from which to work.

In several cases fixtures had to be built for rework of existing planes. Because they must be used not only at the plant but at air bases throughout the world, it is essential to have fixures that can be handled without special equipment.

ACCESS DOOR FIXTURE is typical of small fixtures that are easy to handle and can be stored in high bins to conserve storage space

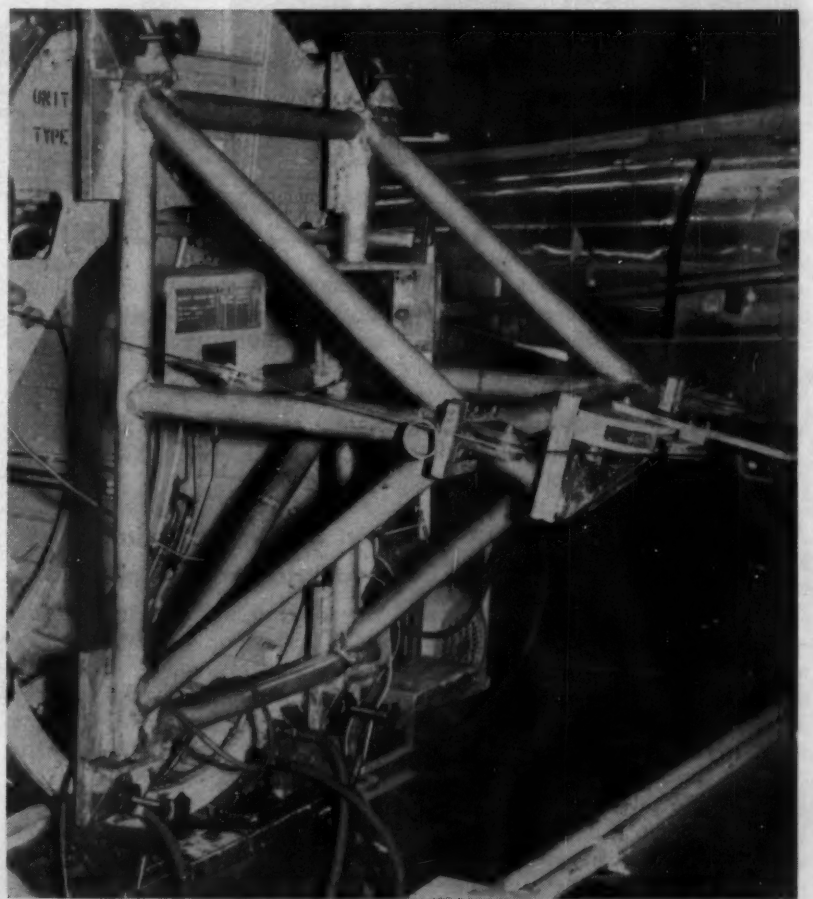


RETROACTIVE FIXTURE for new trailing edges on assembled planes to fit new types of control surfaces was designed for use both at plant and air bases. Use of magnesium held weight to 236 lb. Steel fixture would have topped 1000 lb, been harder to ship and handle, might have twisted the wing

COST PER SQUARE FOOT

THICKNESS	STEEL	ALUMINUM	MAGNESIUM	MASONITE	ERALITE
3/8	1.15	5.09	2.49	.52	1.56
1/2	1.55	5.87	3.32	.68	2.16
5/8	1.90	6.73	4.15	—	2.67
3/4	2.25	7.52	5.00	—	3.27
1	3.10	9.12	6.74	—	4.16
1 1/4	3.80	10.68	8.35	—	5.08
1 1/2	5.05	12.37	10.02	—	6.03
1 3/4	5.90	14.04	11.66	—	7.06
2	6.70	15.87	13.41	—	8.19
2 1/2	8.40	19.51	16.62	—	10.26
3	10.10	22.95	20.00	—	12.21

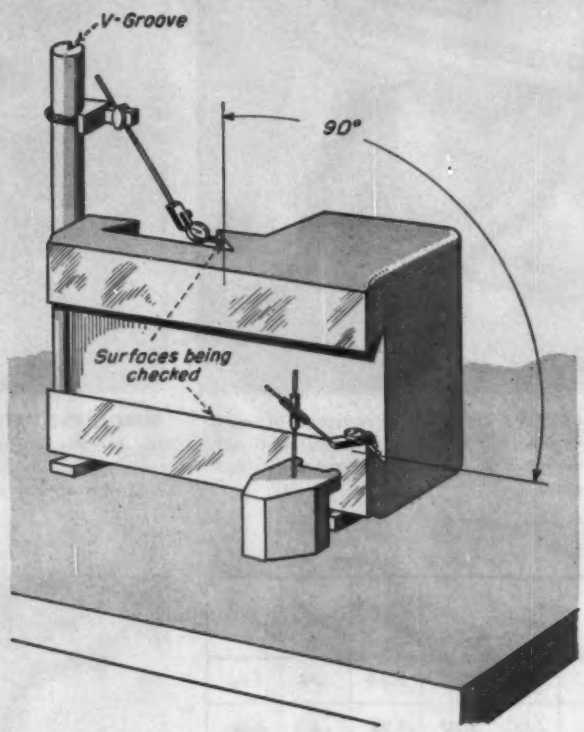
COMPARATIVE COST of tooling plate of different materials is shown in table used at Northrop Aviation, Inc. Prices shown are based on 1000-lb lots at July, 1955, prices at the Northrop plant



PRESETTING CABLES and control rods on tail surfaces of the plane is in area with no overhead crane. Welded magnesium and steel fixture weighs 147 lb, 56 of which are steel. All-steel fixture would have been 476 lb

Except for the data from Northrop Aviation, this article is based on a paper presented at the Magnesium Assn meeting on Nov 1, 1955

Practical Ideas . . .



Groove Widens Circular Square Usage

One of the handicaps of the circular square is that certain surfaces cannot be measured because the square cannot be put next to them. We have ground a V-groove in the side of the square, and added a ball-bearing indicator holder which adds greatly to the usefulness of the tool.

The indicator holder has a vertical strip that carries 2 steel balls, which run in the V-groove. A third ball runs against the column and a spring holds the assembly in place.

The column is 11 in. long, with a 4-in. diameter. It is drilled out to 3-in. diameter, except for 3 in. left in the base for rigidity. The greatest deviation in accuracy of the groove is 0.0002 in., which makes it a very accurate measuring tool.

Shown also is one application of the tool, where a standard surface block with an indicator is used to measure the surface of one horizontal dovetail, while the V-grooved column measures a vertical dovetail. This gives a good measure of the squareness of the slides, which is an often encountered problem in machine tool maintenance and construction.

The frame of the indicator support on the V-grooved square is made of aluminum.

J Hemmes, Hengolo(o), Holland

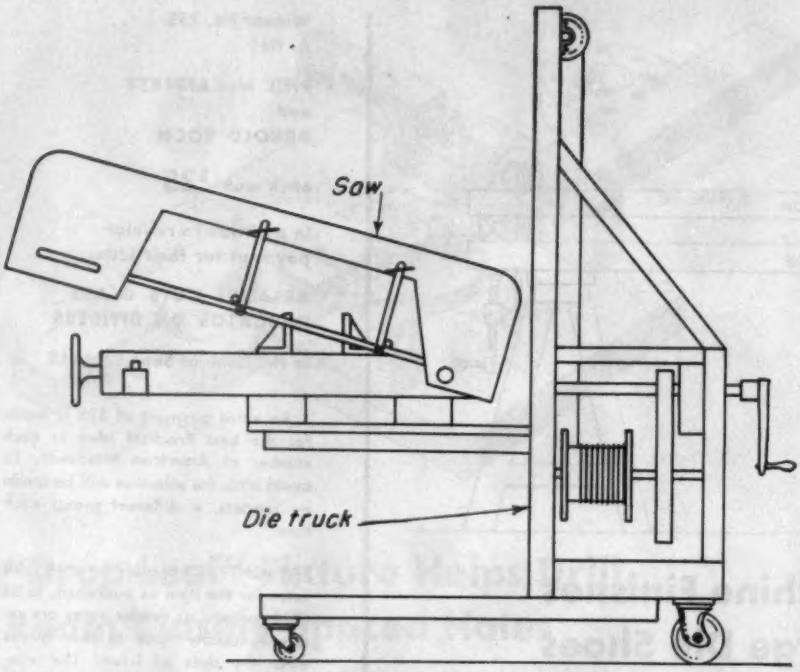
Iron Box and Shavings Avoid Hardening Scale

Very often it is disappointing to see scale formed on a piece that has been machined and then heat-treated, especially if there is a surface on the work that, for some reason, can't be machined after heat treatment.

To avoid this, without having a salt bath furnace, try this method: Make a box of iron plate and fill it part of the way with cast iron shavings (the finer the better) from a lathe or milling machine. Then soak the part to be hardened in ordinary lubricating oil and wrap it in oil-soaked paper. Place this "parcel" in the box and fill the box the rest of the way with more cast iron shavings.

Put the box in the oven and heat to hardening temperature, being sure to keep the temperature high long enough to heat the box all the way through. Remove the box from the oven, grip the component with a pair of tongs, and quench as usual.

Tempering must be done right after hardening, to avoid formation of cracks on the work. *A Ruberg, Cape Town, South Africa*



Portable Bandsaw On Die Handler Speeds, Eases Stock Cutting

In a large toolroom or job shop, there is always a lot of need for blanks to be cut from round stock or square bars in storage on racks. Often all that is needed is one or two pieces cut from the end of the bar.

This means that the bar has to be removed from the rack, transferred to the saw for cutting, and returned to the rack. This usually requires the help of two men and a hand or powered hoist, because, for example, a 10-ft length of 3-in. round stock weighs 240 lb, and it would be unwise to ask one man to handle this without help of a hoist and probably a helper, to get the stock into the saw vise.

We made a study of our method of storing, handling, and cutting stock, and found that when we cut short lengths of stock, the cost of the labor often exceeded the cost of the stock.

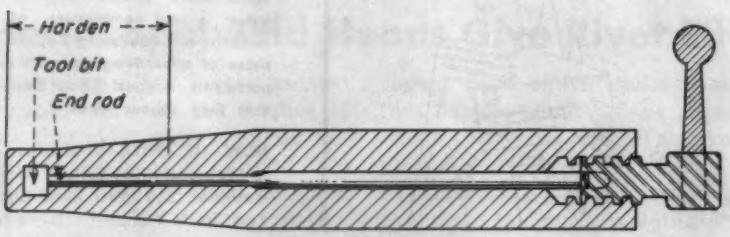
To reduce the amount of handling time and work, we came up with this solution: The floor in the stock-storage area was levelled off and a new stock rack was built, with extra care being taken to insure that all members of the rack were square and parallel to the floor. We then removed the legs from a horizontal bandsaw and mounted the machine on a hand-powered shop elevator, of the type usually used for handling dies.

This unit was altered by replacing the front wheels with casters. Now, to cut off a piece of stock, we pull the stock out of the rack by hand or with the help of a hoist. To provide a grip, a C-clamp is secured to the end of the bar. This clamp has a V-notch cut in the solid jaw, to provide a sure hold on flat or round stock. The vise is locked to the stock and the floor lock is used to hold the elevator in place.

An extension on the edge of the plate catches the piece cut off. The saw will not cut stock placed in the lowest section of the rack, so this part is used for light pieces.

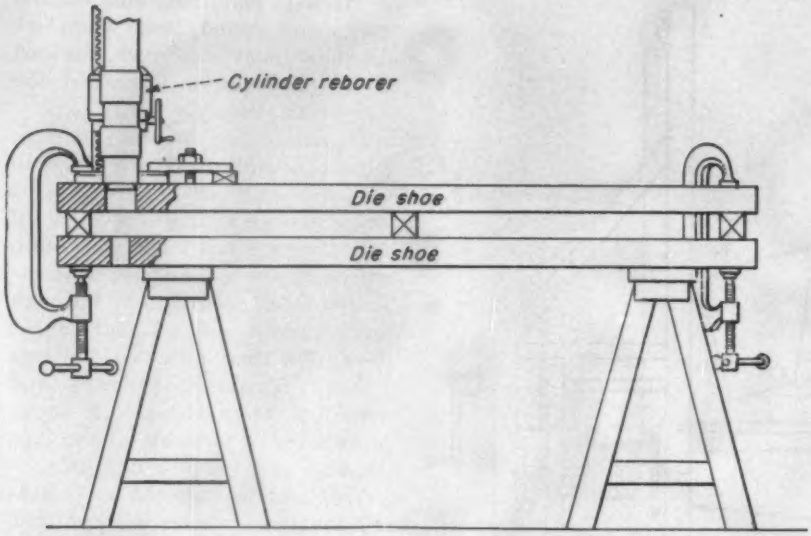
We are well satisfied with this arrangement, which has paid for itself many times over. *Clifford Molloy, Bronx, NY*

Boring Bar Has "Pushbar" To Hold Cutting Tool



This design of boring bars has proven very effective for us, for several reasons. The toolbit is locked or unlocked by simply tapping the screw at the end of the bar, so that tool change is done without risk of skinned knuckles, and without handling small wrenches.

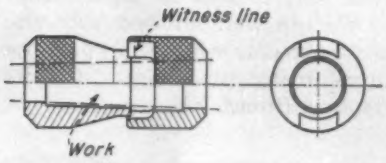
Chatter is also reduced to a minimum, because the Acme screw at the end of the boring bar tightens against the rod and toolbit, setting up a thrust which strengthens the bar against springing. *Lee C Wilkerson, St Louis, Mo*



Cylinder-Boring Machine Finishes Bushing Holes in Large Die Shoes

We had 14 sets of die shoes which had to be bored for bushings, and didn't have a milling machine large enough to handle the work (3 in. x 15 in. x 5 ft).

To do the holes, we borrowed an electric cylinder-block reboring machine—the kind that is used in automotive repair work. The method worked so well, giving us excellent size and finish, that we bought a reborer for general shop use, when similar jobs come along. *A T Renson, Atlanta, Ga*



Simple Two-Piece Device to Gage Taper After Roughing

When it is necessary to check a slight taper, such as a Morse taper, after roughing, this gage will be found sufficiently accurate, quick, and easy to use.

To use the gage, place the rings over the ends of the work. If the end of the left hand ring, which serves as a reference mark on the ring, lies between the corresponding end of the right hand ring and the witness mark, the spacing of the rings is within the limits permitted by the tolerance of the taper.

If the end of the left hand ring is outside the end of the right hand ring, the angle of the taper is too small. If the end of the left hand ring goes beyond the witness line, the taper angle is too big. *Ch Minaire, St Etienne, France*

Winner No. 235
A tie!

PHIL McCAFFERTY
and
ARNOLD KOCH

each won $25

In addition to regular payment for their ideas:

ABRASIVE CUTS GLASS INDICATOR ON DIVIDERS

in the Issue of Sept 12, 1955

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

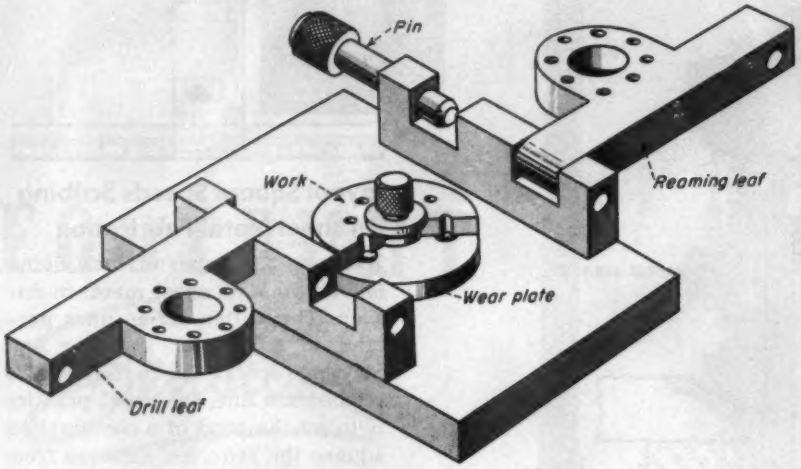
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



"Drop-Leaf" Fixture Helps Drill, Ream Closely Spaced Holes

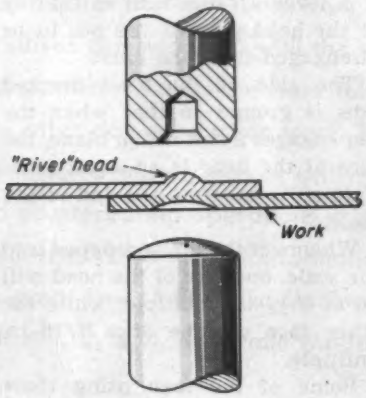
Work which has closely spaced holes often requires drilling and reaming the holes. In many cases it is impossible to fit standard drill bushings, so it is necessary to make drill plates from hardened steel, with guide holes in them. If reaming is to be done, there must be another fixture with the reaming size in the guide holes, in order to complete the operation.

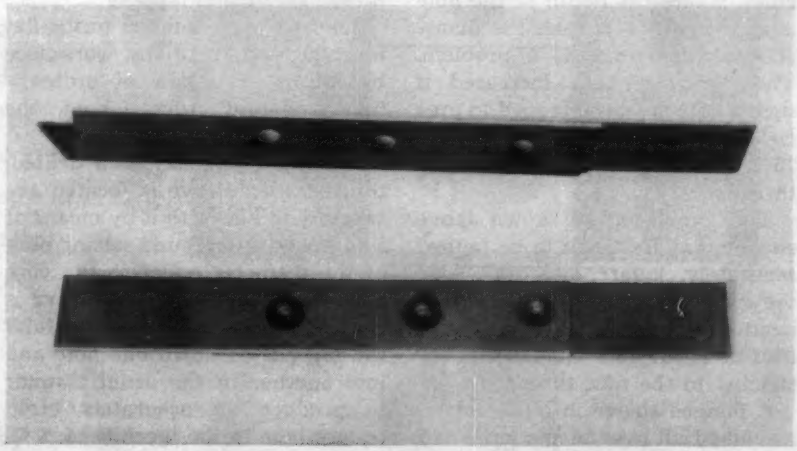
We avoid the necessity of making two complete fixtures and the handling needed to use such fixtures by using the "drop-leaf" fixture shown here. It consists of a base plate on which two members are hinged to swing over the work in succession. The first member is the drill guide plate, which is placed over the work to make the holes, after which it is swung out of the way for the next step.

The second member is the reaming plate, which is then swung over the work, and the holes can be reamed without taking the work out of one fixture and putting it into another.

The parts have a central hole for locating on a stud which is incorporated in the jig. They are locked in place by a thumbscrew and washer.

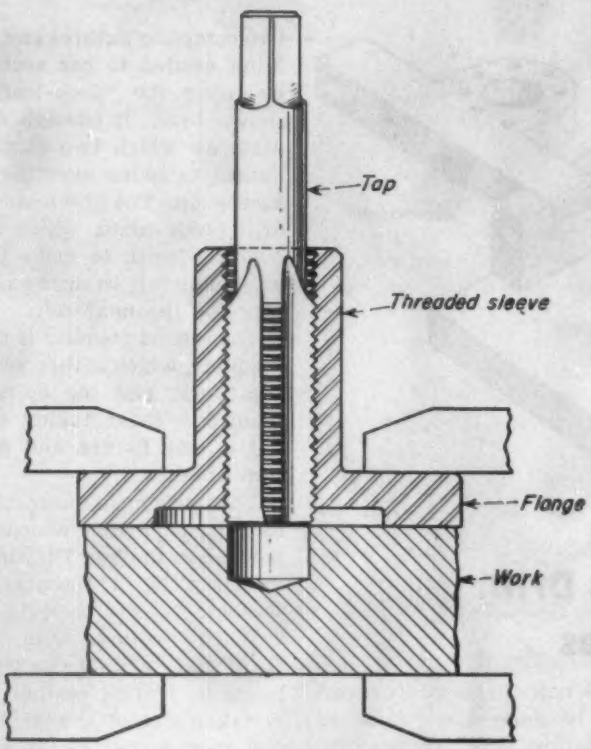
When drilling, with the left-hand leaf, a pin locks the leaf in position. During reaming, the pin is taken out of the drill position and moved over to the other side of the fixture, to hold the reaming leaf in place. *Clifford T Bower, London, England*





Special Spotweld Heads Give Rivet Effect

Spotwelding often leaves an undesirable mark on the surface of work that must be polished off before the surface is finished. To avoid this step, we have designed spotweld heads of the design shown here which make a weld that has the same outside appearance as a riveted joint. This avoids the polishing operation, and gives us a pleasing appearance on the outside of the work. Welding pressure for this job is a little higher than is needed for conventional welding, but tearing tests have shown that we get a consistently strong joint. *George F Herzl, Philadelphia, Penna*



Tap Bushing Helps Cut Short, Blind Threads

Accurate tapping of shallow blind holes, where the depth of the hole is appreciably less than the diameter, always presents a problem. The difficulties are increased if such a hole has to be tapped to precision size having not less than 75% of its depth effectively threaded.

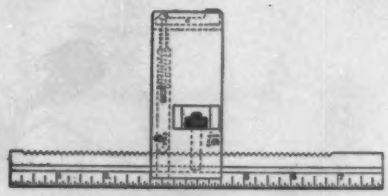
The simple fixture shown above enables shallow holes to be tapped accurately, square, and rapidly, in the simplest manner. An ordinary hand plug tap is ground with a lead of about 12°. This lead is restricted to the first thread.

A flanged sleeve in mild-steel is machined all over in the lathe and provided with an accurately tapped hole which extends the length of the piece. The plug tap is made a very close fit within the threaded hole. The hole is located perfectly square with the machined underside of the enlarged circular flange. This same side of the flange is recessed out to provide ample clearance for chips emerging from the blind hole during tapping.

The sleeve is clamped to the flat machine surface of the workpiece by means of a pair of ordinary finger clamps which hold the flanged portion to the work.

After the hole has been drilled, the threaded sleeve is located accurately in line with it by means of a hardened and ground setting plug of the diameter equal to the core diameter of the hole. The sleeve is then clamped into position, and the tap passed down one hole and into another in the usual manner to produce an accurately sized square hole in the workpiece.

Use of a similar type guide sleeve also greatly facilitates the tapping of holes through very thin sheets. With this class of work the guidance afforded by the long threaded hole in the sleeve prevents tearing or stripping of threads in the thin sheet material. *W H Halliday, Southport, Lancashire, England*



Layout Square Speeds Scribing On Sheet Metal Fabrication

We have a number of men doing layout work on sheet metal in our shop. They often scribe lines parallel to edges, for shearing and bending operations to follow. To scribe each line, the usual practice is to set the head of a combination square the required distance from the end of the scale. To speed up this operation, and to insure more accurate settings, we altered a square to provide an automatic setting feature.

We dispensed with the 45° angle and made a head as shown in the drawing. A series of teeth on ⅛-in. centers were ground in a hardened blade, as shown. The head was made of hardened tool steel, and uses a screw locking clamp, as is used in the commercial head.

Also, it is fitted with a spring-loaded pin which is pointed to fit the teeth in the blade.

A lever arrangement at the top of the head permits the pin to be disengaged from the blade.

The side of the head marked 8ths is ground so that when the pin engages a slot in the blade, the face of the head is an exact multiple of ⅛ in. from the end of the scale.

Whenever the pin is dropped into the scale, one face of the head will be at a ⅛-in. multiple, while the other face will be at a 1/16-in. multiple.

Some of the men using these tools ground a narrow notch in each end of the blade, 1/32 in. deep. This notch is ground right on the end of the blade, but is not shown in the drawing. Thus, to scribe a line at 2 3/32 in., they set the head at 2⅛ in., and place the scriber in the notch, giving them the desired dimension. *Clifford Molloy, Bronx, NY*

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Sensitive

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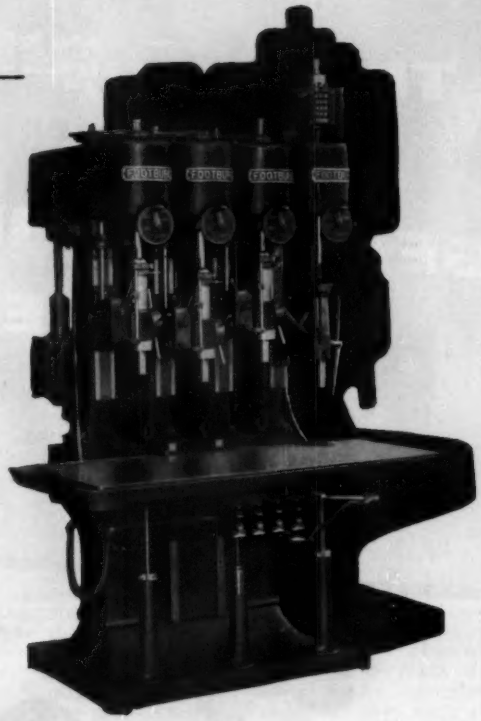

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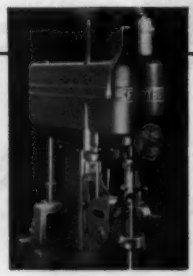

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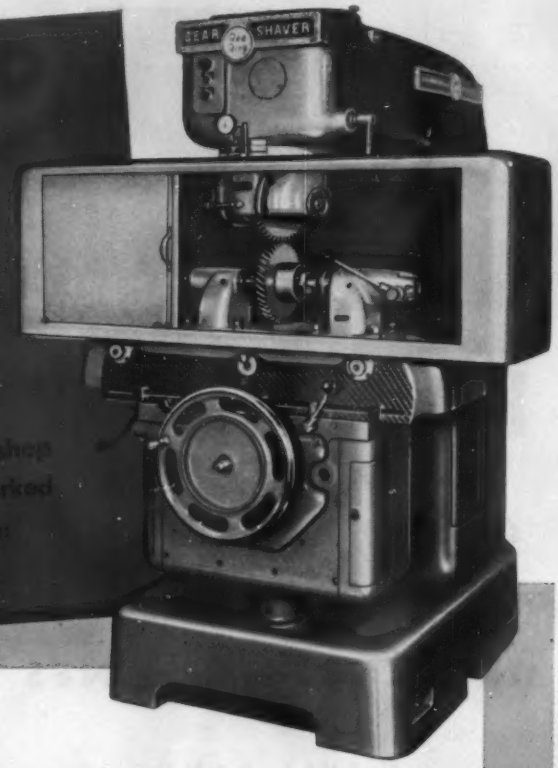

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FLUXES FOR BRAZING—I

Reprinted by permission from "Brazing Manual" prepared by the Committee on Brazing and Soldering, American Welding Society, and published by the Reinhold Publishing Corp, N Y

Nonferrous metals for brazing (*AM*—Oct 24, '55, p130) must wet the surfaces of the joint. Good precleaning of the parts is essential, followed by use of a flux or an active or protective atmosphere for the purpose of dissolving or reducing any oxides or to prevent oxidation.

FLUXES

Fluxes are not designed to, nor are they intended for, the primary removal of oxides, oil, grease, dirt or other foreign materials from the parts to be brazed. All parts for brazing must be subjected to appropriate cleaning operations as dictated by the particular metals.

In the making of a braze the flux is needed to combine with, dissolve, inhibit or otherwise render ineffective those unwanted products of the brazing operation which would otherwise impair the braze or totally prevent brazing.

The flux must remain in contact with the braze area to inhibit the further formation of oxides. Since oxides are the principal source of surface contamination it follows that the dissolution and the removal of the oxides during brazing is an important function of a flux. The flux must also be readily displaced by the molten brazing filler metal.

Viscosity of a flux at brazing temperature is an important property in that it influences the ability of the flux to be displaced by the molten filler metal. Another related property is surface tension of the flux; this also affects the wettability of the base metal and the flow of the filler metal into the joint. Under some circumstances flux may be called upon to suppress the volatilization of high-vapor-pressure constituents in a filler metal.

When brazing copper with a BCuP type of filler metal, the phosphorus acts as a flux. In this case it is possible to braze without using added flux, but in some cases better results can be obtained if a flux is added.

CHEMICALS USED IN FLUXES

Proprietary fluxes are mixtures of many compounds put together in ways that have been found to give satisfactory results for specific purposes. After the chemicals are mixed (and particularly when they are heated as they are during brazing) reactions take place between the various ingredients. Thus, the resulting solution of compounds at brazing temperature is quite different chemically as well as physically from the ingredients which were initially mixed. For instance, if a fluoborate is an ingredient, fluorides are formed after the ingredients are mixed even though they have not been added deliberately.

During the brazing operation the chemistry of fluxes is especially transient. The flux, base metals, the filler

FLUXES FOR BRAZING‡

Important: All materials must be clean before applying flux (see text)

A W S Brazing Flux Type No.	Base Metals on which This Flux is Recommended for Use	Filler Metals on which This Flux is Recommended for Use	Lowest Useful Temperature (°F)	Highest Useful Temperature (°F)	Ingredients (May contain any, some, or all of the classes of compounds listed)	Form as Supplied	Form of Application
1	All brazeable aluminum alloys	BAlSi	700	1190	Chlorides Fluorides	Powder	I, II, III, IV
2	All brazeable magnesium alloys	BMg	900	1200	Chlorides Fluorides	Powder	III, IV
3	*All except those listed under 1, 2, 4 and 6	All except those listed above	700	2000	Boric acid Borates Fluorides Fluoborates (Must contain fluorine compound) Wetting agent	Powder Paste Liquid	I, II, III
4	†Alloys such as Aluminum-bronze Aluminum-brass containing aluminum additions of 0.5% or more.	BAg, BCuZn, BCuP	1050	1800	Chlorides Fluorides Borates Wetting agent	Paste Powder	I, II, III
5	Same as 3	Same as 3 except note the higher temperature requirement and not recommended for BAg 1 through 7	1000	2200	Borax Boric acid Borates Wetting agent. NO FLUORINE IN ANY FORM	Powder Paste Liquid	I, II, III
6	Ti and Zr base alloys	BAg	700	1600	Chlorides Fluorides Wetting agent	Paste Powder	I, II, III

** Some Type 3 fluxes are specifically recommended for Base Metals listed under Type 4.*

† Combinations of Type 1 and Type 3 fluxes may be used on these materials. In some cases Type 1 is satisfactory.

‡ This table provides a guide for classification of most of the proprietary fluxes available commercially. The information given here is generally not adequate, when used alone, for a specific application.

Key to Form of Application:
I. Sprinkle dry powder on joint region.
II. Dip heated filler metal rod in powder or paste.
III. Mix with various vehicles such as water, alcohol, monochlorobenzene, or others, to form a paste or slurry.
IV. Molten flux bath.

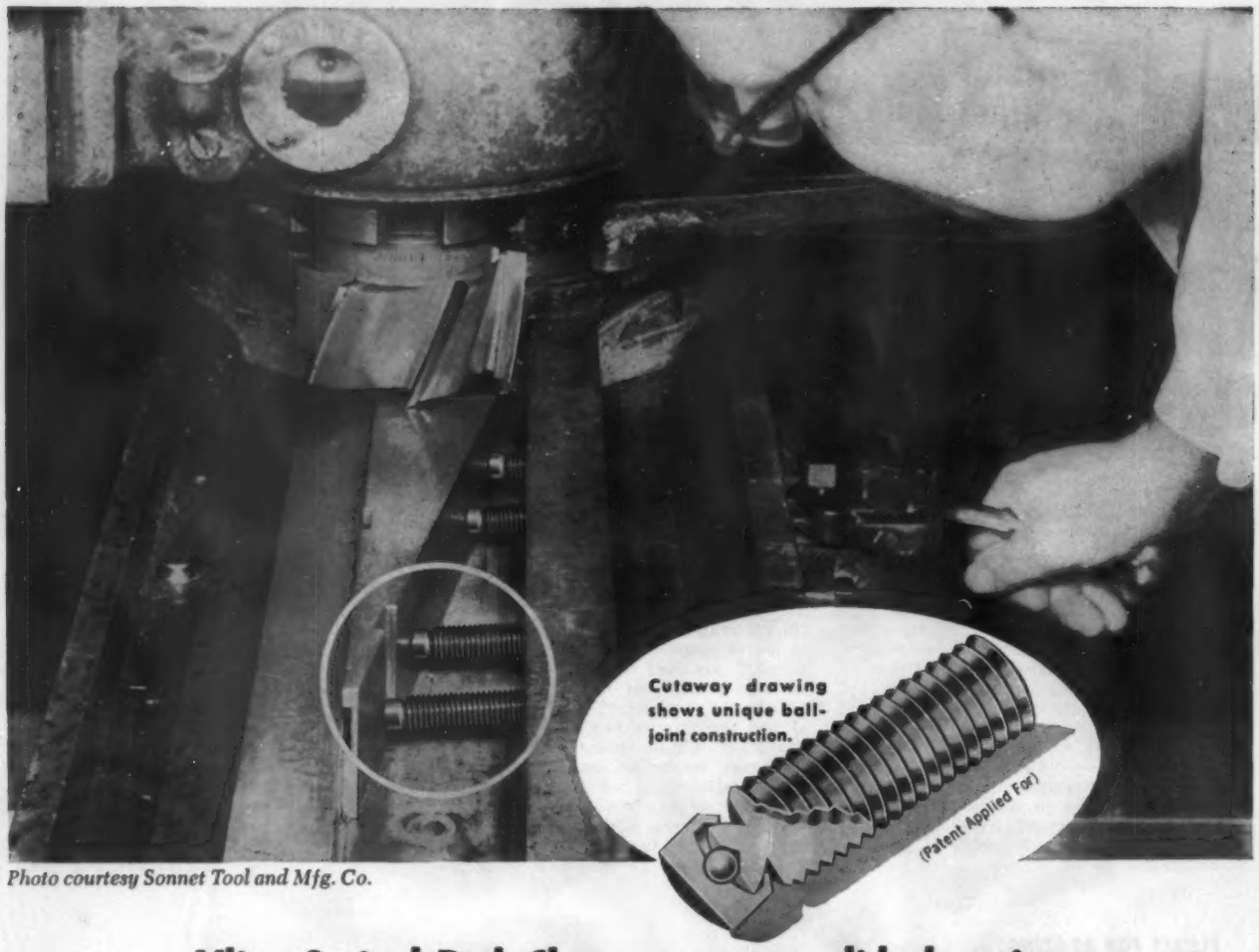

Photo courtesy Sonnet Tool and Mfg. Co.

Vlier Swivel-Pad Clamps assure solid clamping of parts in jigs and fixtures without marring their surfaces

Unique ball-joint construction prevents binding of the pad; assures automatic adjustment to off-angle surfaces

The mill fixture shown above demonstrates the usefulness of Vlier Swivel-Pad Clamps. Four Swivel-Pads are used to clamp the part rigidly in the fixture for the milling operation. Maximum rigidity is imperative in this setup if the high efficiency of the Sonnet "Helicarb" Shell-End Mill is fully utilized.

First touch of the pad against the work piece adjusts the pad face to the surface of the part and stops pad rotation. Extreme clamping pressure can then be applied to the part without damage, since screw torque is taken up by the pad, not the part. Swiveling the pad on a ball eliminates binding and assures frictionless adjustment to off-angle surfaces up to 7½ degrees each side of the center line.

Uniform clamping pressure

Design of the ball-joint causes the clamping force to be distributed equally to every point on the pad face. The pad is machined from solid stock for greater strength. The face of the pad is ground flat, not counterbored or relieved, for maximum holding surface.

Insert from either end

Since the pad diameter is less than the body diameter Swivel-Pads can be inserted in the jig or fixture from either end. This feature is especially helpful where space is limited.

Use it again and again

The body of the Swivel-Pad is made from heat-treated, alloy steel for high strength and long life. A special rust-proof finish prevents the tool from freezing in the jig or fixture.

Eliminate costly makeshift devices

These simple holding tools can save *your* tool room hundreds of dollars every year. Having them available eliminates costly machining of home-made devices and speeds tool manufacture and setups. Swivel-Pads are now available in 23 diameters and lengths. Call your Vlier distributor now and order an assortment of sizes.

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FLUXES FOR BRAZING—II

metals and any gaseous materials that are present react with each other with increasing rapidity as the temperature is raised. The ingredients of the flux must thus be carefully tailored to suit all of the factors in the braze, including time. The flux must not attack the metals too much at the brazing temperature and it must last long enough to enable the joint to be satisfactorily formed. Active halides such as chlorides and fluorides are, for instance, necessary in a flux for aluminum or other highly electropositive metal bearing alloys, and some particularly active fluxes must be mixed just before use to avoid reaction during storage.

The following list of chemical compounds includes the most common ingredients of fluxes.

Borates (sodium, potassium, lithium, etc.)
Fused borax
Fluoborates (potassium, sodium, etc.)
Fluorides (sodium, potassium, lithium, etc.)
Chlorides (sodium, potassium, lithium)
Acids (boric; calcined boric acid)
Alkalies (potassium hydroxide, sodium hydroxide)
Wetting agents
Water (either as water of crystallization or as an addition for paste fluxes)

Borates. These compounds are useful in formulating the higher melting fluxes. They have good oxide-dissolving power and provide protection against oxidation for long periods of time. Most of the borates melt and are effective at temperatures around 1400 F or higher. Even in the molten condition they have a relatively high viscosity and therefore must be used with other salts.

Fused Borax. Fused borax is another high melting material that is active at high temperatures. However, it is little used in the lower melting fluxes.

Fluoborates. Fluoborates react similarly to the other borates in many respects. However, they do not provide protection from oxidation to the same extent as the other borates. They flow better in the molten state and have greater oxide-dissolving properties than the other borates. Fluoborates are used with other borates or with alkaline compounds, such as carbonates to make a flux. Another related class of compounds is fluosilicaborates. These are somewhat higher in melting point than the fluoborates and provide good coverage and surface adherence. The high melting point limits their use.

Fluorides. The fluorides react readily with most metallic oxides at elevated temperatures and are therefore used in fluxes as cleaning agents. They are particularly important in applications where refractory oxides, like chromium oxides, aluminum oxides, etc. are encountered. In addition to cleaning, the fluorides increase the fluidity of molten borates, thereby improving capillary flow of filler metal.

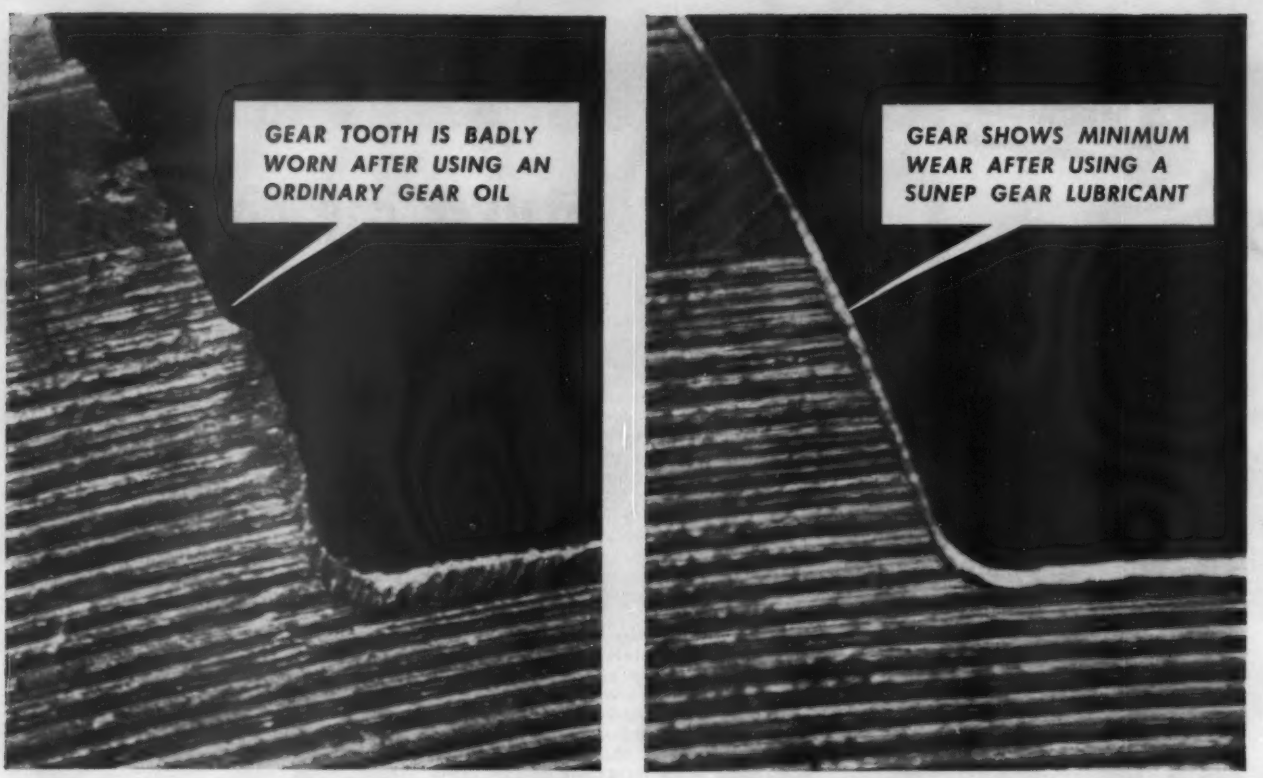
Chlorides. The chlorides function in a manner similar to that of the fluorides. They are less costly but less effective. Chlorides must be used judiciously because at elevated temperatures, they tend to oxidize the work.

Boric Acid. Boric acid is a principal constituent in brazing fluxes. It is

ATMOSPHERES FOR BRAZING

A W S Brazing Atmosphere Type Number	Source	Maximum Dew Point °F, Incoming Gas	Approximate Composition				Application		Remarks
			%H_2	%N_2	%CO	%CO_2	Filler Metals	Base Metals	
1	Combusted fuel gas (low hydrogen)	Room temp.	.5-1	87	.5-1	11-12	BAg* BCuZn*, BCuP	Copper, brass*	
2	Combusted fuel gas (decarburizing)	Room temp.	14-15	70-71	9-10	5-6	BCu, BAg*, BCuZn*, BCuP	Copper†, brass*, low-carbon steel, nickel, monel, medium carbon steel§	Decarburizes
3	Combusted fuel gas, dried	—40	15-16	73-75	10-11		Same as 2	Same as 2 plus medium and high-carbon steels, monel, nickel alloys	
4	Combusted fuel gas, dried (carburizing)	—40	38-40	41-45	17-19		Same as 2	Same as 2 plus medium and high-carbon steels	Carburizes
5	Dissociated ammonia	—65	75	25			BAg*, BCUZn* BCu, BCuP BNiCr	Same as for 1, 2, 3, 4 plus alloys containing chromium‡	
6	Cylinder hydrogen	Room temp.	97-100				Same as 2	Same as 2	Decarburizes
7	Deoxygenated and dried hydrogen	—75	100				Same as 5	Same as 5 plus Co, Cr, W alloys and carbides‡	
8	Heated volatile materials	Inorganic vapors (i.e., zinc, cadmium, lithium, volatile fluorides)					BAg	Brasses	Special purpose. May be used in conjunction with 1 thru 7 to avoid use of flux
9	Purified inert gas	Inert gas (e.g. helium, argon, etc.)					Same as 5	Same as 5 plus titanium, zirconium, hafnium	Special purpose. Parts must be very clean and atmosphere must be pure
10	Vacuum pumping	Vacuum					Any metal which does not vaporize	Any metal which does not vaporize	Special purpose. Elaborate equipment and procedure

** Flux required in addition to atmosphere when alloys which contain volatile components are used.*
† Copper should be fully deoxidized or oxygen-free.
‡ Flux must be used in addition to the atmosphere if appreciable quantities of aluminum, titanium, silicon, or beryllium are present.
§ Heating time should be kept a minimum to avoid objectionable decarburization.



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Sunep Gear Lubricants cut power losses...protect against overloads ...lengthen gear life...reduce maintenance costs and replacements.

During recent tests gear units protected by Sunep Gear Lubricant showed an absolute minimum of wear when run at normal rated capacity. There was no indication of scoring or wear even when run at overloads up to 118%! Power consumption was reduced up to 25%. Damage from shock loads was nil.

In addition to outstanding load-carrying ability, Sunep Gear Lubricants are extremely stable, non-corrosive, prevent rusting, keep gears and bearings clean.

For complete information about how Sunep Gear Lubricants can help give longer life to your worm gear units, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-11.

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FLUXES FOR BRAZING—III

employed in conventional form or sometimes in calcined form. The calcined form reacts similar to boric acid but has a somewhat higher melting point. Boric acid is employed principally as a cleaning agent. However, it is used in a flux because it improves the viscosity of the flux residue. Further, it has the property of facilitating the removal of the glass-like flux residue after brazing. The melting point of boric acid is best described as being below that of the borates but higher than that of the fluorides.

Alkalies. Potassium and sodium hydroxide are used sparingly, if at all, because of their deliquescent properties. Even small amounts involved with other flux agents can create difficulty in humid weather. When used, the function is to elevate the useful working temperature of the flux.

Wetting Agents. Wetting agents are employed in paste and liquid fluxes to facilitate the flow or spreading of the flux onto the work piece prior to brazing. Obviously, wetting agents must not affect adversely the normal functions of the brazing flux.

Water. Water will be present in brazing fluxes either as water of crystallization in the chemicals used in formulating the flux or as a separate addition to the flux for the purpose of making it a paste or liquid. If the water of crystallization is undesirable in a chemical about the only way to remove it is to calcine that particular ingredient. Water which may be used to form a paste must be checked as to its suitability, and excessively hard waters should be avoided. In mixing fluxes, if the available water is unsuited, then employ alcohol.

CHOICE OF FLUX

Economic considerations are of course of primary importance. The choice of flux and technique of use greatly influence the time required to make a braze and the quality of the braze. There is no single flux which is best for all brazing applications. There are many variable conditions, i.e., base metal, filler metal, method of brazing, time required to braze, complexity of joint, etc. Necessarily, there are many useful formulations of flux, each compounded somewhat differently from the other and each having its optimum performance region different from the others. These formulations can, however, be classified into six groups according to their characteristics. A table lists these groups with an AWS Brazing Flux Type Number assigned to identify each group. The range of functions covered within each group is wide. Hence, no single flux formulation will best satisfy all of the requirements listed for that type number, but with few exceptions each flux formulation can be assigned a definite single type number and will perform satisfactorily over most of the range stated.

Within a particular AWS type number of flux, there are several criteria for choosing a specific flux for maximum efficiency:

1. For dip brazing, water (including water of crystallization) must be avoided.
2. For resistance brazing, the flux mixture must allow the passage of current.
3. The effective temperature range of the flux must include the brazing temperature for the specific brazing filler metal involved. This is important both on the high side and the low side of the temperature range. If the time during brazing is long, a less active and longer-lived flux is desirable; a quick heating cycle (such as in induction brazing) needs a more active flux and long life is not required. If a nonoxidizing atmosphere is used, the life of the flux is prolonged.
4. Ease of removal of flux residue should be considered.
5. Corrosive action on the base metal or filler metal should be minimized.

METHODS OF APPLYING FLUXES

Fluxes for brazing are generally available in the form of powder, paste or liquid. The form selected depends upon the individual work requirements, the brazing process and the brazing procedure.

Frequently, powdered flux is mixed with water or alcohol to make a paste. The powder may also be used in the dry form and sprinkled on the joint, although adherence in this form is not as good.

Paste is probably the most commonly used form for applying brazing flux. It can be applied to a joint and filler metal before brazing with good adherence. A diluted paste flux is used where the flux is to be sprayed on a joint. Certain flux ingredients will completely dissolve in water to produce a liquid solution which is called "liquid flux" (see Type 3).

The particle size of dry flux or paste flux is sometimes important. Better fluxing action will result when all constituent particles of a flux are small in size and thoroughly mixed. Ball milling or grinding of a flux mixture shortly before use may be helpful.

Liquid flux of Type 5 is used almost exclusively in torch brazing. The fuel gas used is passed through the liquid flux container thus entraining the flux in the fuel gas. Usually a small amount of other flux is preplaced and serves to flux the joint surroundings.

Mixtures of powdered filler metal in flux have been successfully used for preplacement of both flux and filler metal.

FLUX REMOVAL

Flux residue should be removed to avoid corrosion from active chemicals remaining in it. The residue obtained from a flux, particularly when considerable oxide removal has occurred, is actually a form of glass. The less the flux is required to clean the metal, the less will be the formation of glass and the easier the task of removing the flux residue.

Flux removal from properly cleaned, brazed parts can usually be accomplished by washing in hot water. Thorough drying is recommended.

For residues having a moderate amount of glass, removal may be accomplished by immersing the brazed joint in cold water. This creates a thermal shock which cracks off the residue. This method should not be used where the thermal cycle involved will impair the strength of the brazed joint.

For residues which are difficult to remove, a chemical dip may be used.

Mechanical methods for removal of flux residues are usually limited to cases where the above methods will not be effective because of the high glass content. Among mechanical means used are fiber brush, wire brush, sandblasting, shotblasting, steam jet and chipping. Soft metals such as aluminum are susceptible to embedment of flux residue particles.

It should be apparent that the use of an adequate amount of the proper flux will make flux removal easier. Where experience shows that the more difficult methods must be used, use of a greater amount of flux should be considered.

CONTROLLED ATMOSPHERES

Controlled atmospheres are employed to prevent the formation of oxides during brazing and in most cases to reduce the oxides present so that the brazing filler metal can wet and flow on clean base metal.

Like fluxes, controlled atmospheres are not intended primarily for the removal of oxides, grease, oil, dirt or other foreign materials from the parts to be brazed. All parts for brazing must be subjected to appropriate prebraze cleaning operations as dictated by the particular metals.

Controlled atmospheres are most commonly employed in furnace brazing. However they may also be used for induction brazing and resistance brazing in special cases. In applications where a controlled atmosphere only is used, the brazed parts are generally ready to use with no necessity for postbraze cleaning. When flux is required, the use of a controlled atmosphere may still be desirable.

The use of controlled atmospheres avoids formation of oxides and scale over the whole part and permits finish machining to be done before brazing in many applications. In some applications, such as electronic tube manufacturing, the elimination of flux is of tremendous importance. Some types of equipment (e.g. metallic muffle furnaces and vacuum systems) may be damaged by use of flux.

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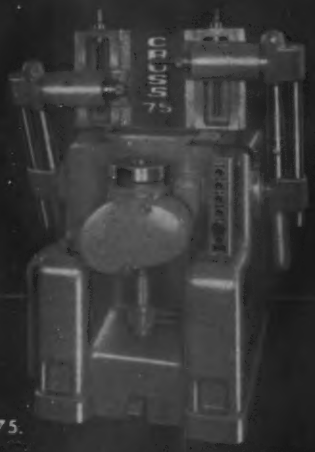
NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



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For burring or chamfering both ends at the same time—
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Typical production—chamfering 8 pitch 40 tooth gears—200 net hourly.

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Special MACHINE TOOLS

Talking Shop...

Revolution?

THE TERM "second industrial revolution" is being bandied about increasingly as talk about automation grows more general. A new thought is added by Sir Walter Puckey, president of The Institution of Production Engineers. Sir Walter thinks we might better call this new era the Industrial Renaissance. He says it started with the discovery of man's power helped by the machine "when a significant number of people realized that in developing the machine age we had forgotten man."

In this Renaissance, Sir Walter told the recent conference at Margate on the automatic factory, man's brawn will be augmented by mechanization, his brain-power will be augmented through more control power, and his emotions will be controlled by better managerial power. This may, in due course, provide him with greater leisure to escape into the troubles of leisure.

New Low

A MAGNETIC REFRIGERATOR that will maintain lower temperatures than any previous apparatus has been developed at Arthur D Little, Inc, Cambridge, Mass. Design represents a major departure. It is based on a cyclic principle of magnetic cooling originated by Drs John G Daunt and Clifford V Heer of Ohio State University.

There are no moving parts or flowing fluids. A plastic capsule 3 in. long contains a special chemical salt as the refrigerant. Operation is controlled entirely by external magnetic fields. The fact that certain materials will warm up when magnetized and cool when demagnetized has been used for several years in a few cryogenic (low-temperature) laboratories for achieving extremely low temperatures in the range of absolute zero (–459.6 F). This is the first apparatus, however, that has been able both to produce these extreme low temperatures and to maintain them for long periods of time. The ADL Magnetic Refrigerator is believed to represent the first commercial application of "superconductivity." This is a change that certain metals undergo at very low temperatures in whih they lose all resistance to an electric current. At the same time, metals in the superconducting state act essentially as thermal insulators but conduct heat readily when not showing the superconducting effect.

Doubled Blow

BOEING ENGINEERS have been experimenting with "shooting" a Cecostamp hammer, the idea being to increase force of the blow delivered. (Normal operation is with air pressure both sides of the piston, to adjust blow force). They put hinged latches at the sides of the piston head on a 4500-psi machine, so the piston is held until appreciable pressure is built up behind it and a vacuum created in front. Then latches are pulled back hydraulically and the piston "shoots" down, with compressed - air force supplementing hammer weight. Despite predictions of trouble, the setup worked successfully, about doubling force of blow. However, it was found necessary to add an automatic control to prevent a double hit—human reflexes are too slow to catch it after the first blow.

Object of the experiments was to replace slower hydropressing of parts. The setup is somewhat like that for hydropressing—a male die only, mounted on an anvil of steel 24 in. in ID and 6 in. thick. The hammer has a mating ring of forged steel 18 in. high, filled to within 3 in. of the striking surface with rubber of 80-90 durometer hardness. A second 1½-in.-thick rubber disk is placed over the metal to be formed. When the hammer comes down, the rubber fills the cavity between dies, forcing the metal to shape over the male die. Parts with flange lengths 50% greater than those from hydropressing are formed, hand finishing has been drastically cut, and Stratofortress and Stratotanker parts are cheaper. With a 16-in.-ID head ring, pressures up to 16,000 psi have been developed. (Chambersburg Engrg Co, which builds the Cecostamp, is reportedly now building a machine with 60-in.-ID head ring, incorporating these ideas.) Best of all, the hammer can form metal up to 1000 F—it is so rapid the rubber isn't burned.

Preview

PERHAPS most unusual purpose for a model at the Chicago Shows was that for the Landis crankshaft-line setup. This was a model of a line not yet built—and for automotive use at that. Usually, nobody sees an automotive setup until it has been working for months.

Sorry, Wrong Number

WORKERS HAVE TO USE an intercom telephone system to communicate with one another on Lockheed's wing jig for the 1649A Super Constellation. The 150-ft length of the wing requires a jig that cost more than $100,000 and with associated tools adds up to $750,000.

Wings are usually fabricated in left and right sections at Lockheed, but the new wing is assembled vertically in a single piece, then separated and mated into the interconnect section on the fuselage.

Special aluminum "yardsticks" are included to detect changes in size caused by temperature change in the plant. To our surprise, Lockheed has made the jig portable so it can be moved as assembly lines expand.

We'll watch with interest to see what happens when they start the optical layout work on a wing, need to phone the man at the other end of the jig, and are connected with the fuselage section by mistake.

News of Metalworking . . .

CAPITAL SPENDING: 1956 Will

. . . and it may carry on into 1957, according to a preliminary survey of Business's Plans for New Plant and Equipment just made by McGraw-Hill's Economics Department

NEW YORK—Industry can look forward to a banner year, the best since Korea, in the purchase of new plant and equipment for 1956. Possibly, the high level of capital spending will carry over well into 1957, too, according to a preliminary survey made among top executives in virtually every U S industrial and commercial field by the McGraw-Hill Department of Economics.

In a nutshell, the survey shows:

U S business will spend 13% more for new plant and equipment in 1956 than it did this year—the biggest increase in planned capital spending since 1951. U S business as a whole will spend $33.4 billion on capital goods next year, as compared with 1955's $29.4 billion.

Within this frame, manufacturing companies will increase their plant and equipment spending 30% in 1956. This is far and away the biggest post-Korea jump.

The boom in capital spending could easily go on through 1957, judging from the large proportion of firms who will spend at least as much in 1957 as they will in 1956.

Optimism over 1956 is widespread. No recent survey has showed an anticipated sales rise by so many companies in so many fields.

Without exception, manufacturing firms plan to spend more for capital goods in 1956, with three industries —automobiles, primary metals, and chemical manufacturing—leading the way. Manufacturing expansion is following along the same lines as it did during the Korea boom, when primary metals manufacturers upped their capacity tremendously. The 1955-over-1956 expansion figures for steel and for non-ferrous producers are astonishing — 72% and 54% respectively.

The automobile industry dominates Metalworking's capital expansion plans—68% or $1.9 billion for 1956—the largest total for any single manufacturing industry. This doesn't include dies, jigs, fixtures and special tooling. Previous record high was $1.3 billion in 1954.

Machinery and electrical machinery manufacturers, too, plan a sharp increase in plant and equipment spending, but it's not expected to equal 1953's record high.

The chemical and petroleum refining industries, more or less dor-

1956 MANUFACTURING CAPITAL SPENDING PLANS

(millions of dollars)

Industry	1954 (actual)	1955 (est.)	1956 (planned)	% change 1955-56
Iron & Steel	$ 676	$ 865	$ 1,488	+72%
Non-ferrous Metals	209	320	493	+54
Machinery	694	788	846	+ 7
Electrical Machinery	439	449	507	+13
Autos	1,295	1,145	1,924	+68
Transportation Equipment (including aircraft)	191	280	319	+14
Other Metalworking	630	680	802	+18
ALL MANUFACTURING	9,039	9,299	12,090	+30

CAPITAL SPENDING IN 1956 (millions of dollars)

Industry	1954 (actual)	1955 (est.)	1956 (planned)	% change 1955-56
All Manufacturing	$ 9,039	$ 9,299	$12,090	+30%
Petroleum Industry	4,850	5,026	5,320	+ 6
Mining	396	358	304	-15
Railroad	854	910	1,156	+27
Other Transportation & Communications	2,954	3,143	3,647	+16
Electric & Gas Utilities	4,219	4,445	4,001(2)	-10
Commercial	6,379	6,971	7,668	+10
ALL BUSINESS (1)	27,891	29,424	33,361	+13

HOW 1957 SPENDING WILL COMPARE WITH 1956'S

	No. of Co's answering		
	More	Less	About same
Iron & Steel	29%	29%	42%
Non-ferrous Metals	23	23	54
Machinery	24	21	55
Electrical Machinery	10	28	62
Autos	17	33	50
Transportation Equipment (including aircraft)	12	52	36
Other Metalworking	15	27	58
ALL MANUFACTURING	22	26	52
Mining	20	25	55
Railroads	5	43	52
Other Transportation & Communications	47	20	33
Commercial	19	21	60

See a Boom

mant since a big upsurge in 1951-53, are on the expansion move again—a 34% increase for chemicals, and 13% for oil refineries. Also slated for higher outlays in 1956 are: paper and rubber, food processing, textile manufacturing (after a long-term slump), railroads, other transportation and communications industries, airlines, shipping, trucking; chain, mail order and department stores, and telephones.

On the debit side in comparative capital spending between this year and next are mining (down 15%, mostly in non-ferrous; coal and iron will stay about the same), electric light and power companies (10% less, with generating equipment down, transmission and distribution facilities up), and gas utilities (10% less, mainly because of a curtailment in pipeline spending).

What about 1957? It looks good, too. More than half the surveyed companies will keep their 1957 spending on a par with 1956's, and in manufacturing and all other major groups except railroads, one firm in five plans to increase its spending in 1957. Added up, three-fourths of the surveyed firms in all fields will do as well or better in 1957 as in 1956.

Look to these fields as the long-run leaders in purchase of new plant and equipment: chemicals, rubber, paper and airlines.

Why this capital goods buying spree? It's simple — firms in every field of the U S economy look forward to a sales boost averaging 7% next year — with manufacturing, chemical and textile companies wearing the rosiest glasses. Each of them expects a boost of 9% over 1955.

Paradoxically, 1956's leaders in capital expenditures don't expect sales boosts up to the national average. Iron and steel looks forward only to 5% more sales, automobiles 6%. This also holds true of the nonferrous metals producers, who predict only a 2% sales increase. The auto and ferrous metals industries' reluctance to predict big sales gains in '56 are understandable. Both industries broke all time records in 1955, and any sales increase at all calls for a tremendous volume to back it up. Their expansion programs are geared to past-1956 expectations.

Congress Takes An Anti-trust Look-See At the Granddaddy of 'Em All—GM

WASHINGTON — General Motors Corp — World's largest industrial organization—is undergoing a thorough and critical examination by the Senate Antitrust and Monopoly Subcommittee.

The stated purpose of the scheduled four-week hearing on GM is to consider what the national policy toward "big business" should be. GM is serving as Exhibit A.

Several months ago, GM declined the invitation of the committee to join—with all the other automobile makers and most of the major steel producers — in a consideration of mergers and concentration in the auto and steel industries. Now, every phase of GM's far-flung operations is getting the full attention of the committee.

One topic sure to occupy a great deal of the Committee's time is GM's dominant position in the auto industry, with special emphasis on the corporation's relations with its dealers and its strong and commanding position in the auto parts industry.

But the committee early turned to an examination of GM's non-automotive enterprises, which account for roughly 15% of GM's annual net sales of $10-billion. Getting down to cases, the committee first looked at the diesel locomotive field, which GM entered in 1934. Today GM produces about 76% of all diesel locomotives used in the U S.

Witnesses from other diesel makers — Baldwin-Lima-Hamilton Corp, Fairbanks Morse & Co, and Alco Products Inc—said, despite GM's dominant position, competition is "tough" in the industry. They ascribed GM's quick growth in the industry largely to its being "all tooled up and ready to mass produce" diesels at the end of World War II.

Metal Treating Achievement Awards...

presented at the annual meeting of the Metal Treating Institute October 14-16 in Philadelphia, went to E H Kinne (left) and L L McArthur (right) of Rollway Bearing Co, Syracuse, N Y for an article on dimensional control finishing. Making the presentation is retiring MTI President C M Cook

TANK PROGRAM: Chrysler's Out, Alco's

WASHINGTON—The Army is slashing by more than half its M-48 Patton tank production program, and Alco Products Inc, Schenectady, NY, becomes the sole producer after next spring.

The Pentagon has announced that Alco has won a $73-million contract for MS-48s, with delivery schedules coming due about June 1.

At approximately the same time, Chrysler Corp will complete a $160-million contract for M-48 production at its Newark, Del, plant.

The Alco award thus brings the tank production program full circle since Defense Secretary Charles E Wilson first instituted his controversial one-line production program two years ago.

Since the Korean War's end, when the single supply principle was adopted, the M-48 business has gone like this:

- General Motors' Fisher Body Division, $200 million.
- Chrysler Corp, $163 million.
- And now, Alco, $73 million.

A year ago, Chrysler underbid both GM and Alco to win the business. This year, GM didn't even try to win back the business, and only Chrysler and Alco entered bids.

The Pentagon will not disclose either the numbers of tanks involved or the dollar spread that was involved in the competitive bids. On the latter point, however, corridor scuttlebut in the defense establishment has it that the contractors took pains to see that the business was passed around.

Insofar as can be determined, this is nothing more than gossip, although the Army, indirectly at least, gave some credence to it. It said the Alco "proposal was low," but declined to answer when newsmen asked for elaboration—namely, whether the Alco bid was, in fact, the lowest.

One fact is not in doubt: the Army is cutting down its tank orders.

The M-48, brought into production during the Korean War, is the only tank now being produced. It is a low-silhouette vehicle with a one-piece solid design turret and armor shield and, on the basis of its 90-mm cannon, rates as a "medium gun."

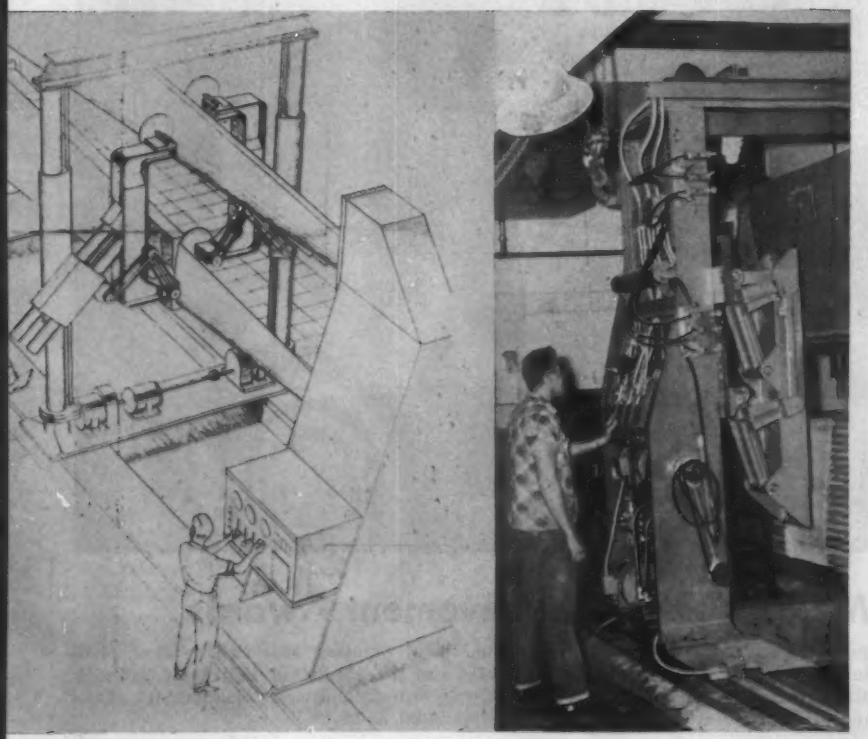
Its cost is about $109,000 per vehicle. On this basis, you could calculate that since Korea the Army has purchased some 3600 or so M-48s for the $433 million of contracts that went to GM, Chrysler and, now, Alco.

That figure could be way high or way low—either way, the Pentagon isn't saying. At any rate, it's pretty obvious that the military strategists feel the tank supply has reached the point where an easing off in production won't be damaging.

Actually, this easing off has been going on, in a less dramatic fashion, since 1953.

The big slash in tank spending now envisaged for next year will let the

How to Shape Honeycomb Aircraft Structures—



Honeycombs of aluminum, glass fiber, stainless, even impregnated paper, add strength to waste spaces inside wings and tails — without adding much weight. But one critical problem has been producing compound curves. U S Propellors has a method and a pair of machines to do it

USP's G-4 MACHINE (left) contours ice-bound honeycomb with cold saws. Horizontal bed has traveling frame that carries sawblades and model followers. Saws reciprocate up and down, cut in both directions. Carriage (photo) with saw and templet follower removed during setup looks like this. Supporting arms for blades and followers are counterweighted. Leadscrew in base moves carriage at ⅛ in. per vertical stroke. Machine takes 7-15 strokes per min with linear carriage feed of 8-100 fpm

In—for What's Left of M-48 Output

Army put what it calls "proportionately greater emphasis" on atomic weapons, guided missiles and helicopters. (The Army was no more specific than that about the other weapons, but one it apparently hoped to take over was the so-called "middle range" missile, that can explode on targets 1000 miles from the launching point. The Army settled an inter-service dispute last week by handing that plum to the Air Force.)

At this point, the Patton tank is indisputably the best in the American arsenal. But Army spokesmen duck direct answers to such questions as this: does the slow-down signal a transitional period in which we are about to come up with a new, better tank?

"Always," they say, "we're looking for improvements through either new design or better results with different combinations of components now in use."

They are fairly certain that the atomic age is not going to make the tank obsolete as a weapon of war. The M-48 has already been put to a moderately severe atomic test, which it passed satisfactorily.

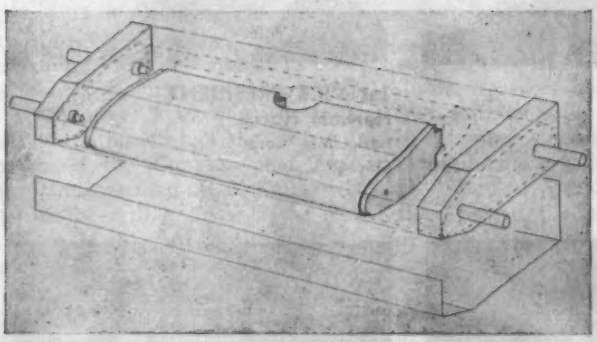
That occurred last March, when 55 Pattons were used as a spearhead for Armored Task Force "Razor" during atomic exercises at the Nevada Proving Grounds. Some were only 3200 yards away from ground zero of an A-bomb blast equivalent to 40,000 tons of TNT. None of the tanks was damaged, nor did their crews suffer any ill effects so far as is known. The tankmen drove the vehicles into a simulated combat action as part of the exercise immediately following the blast.

The Alco contract's size is, according to competent Pentagon observers, just about the minimum possible to maintain a tank production line. The Pentagon doesn't quite put it like that, but official spokesmen point out that it will keep "essential industrial know-how" at work in a plant where rapid expansion would be possible in case of emergency.

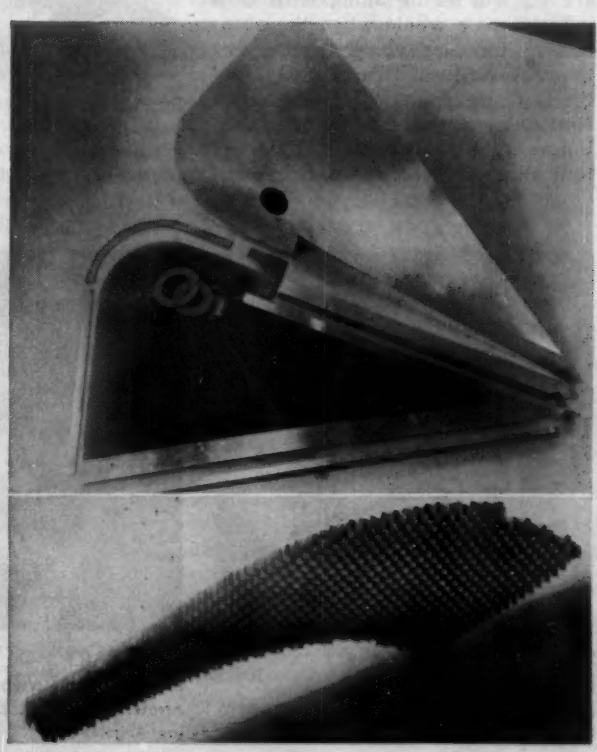
Getting the M-48 rolling by next spring should pose no serious problem to Alco. It has the tools, and in fact has built the tank before—during the hectic Korean days when mass production from multiple lines was urgently needed. At that time, four producers were building the Patton under contract.

When it first publicly announced the M-48 in July, 1953, the Defense Dept identified GM's Fisher Body Division, Chrysler, Ford and Alco (then American Locomotive) as the producers. Ford subsequently dropped out of the tank picture as the production base was narrowed. It made no effort to get back into it, either last year when Chrysler took over, or this year when Alco got back.

Just Freeze 'Em in Ice and Carve Away!



HONEYCOMB WITH END PLATES BONDED IN PLACE is fitted with wood or aluminum end frames set in wood or cardboard tray. Assembly is submerged in water and frozen at 20 F, then machined in room held at 30 F. Ice can't distort open-ended cells



TYPICAL HONEYCOMBED ASSEMBLY (top right) is aluminum, for jet fighter wingtip. Edges and inserts are formed or forged parts. Sheet metal skin will be applied to curved top and bottom surfaces, which must be supported for machining.

GLASS FIBER HONEYCOMB CORE is for a jet fighter tail fin. Its compound curves on both sides prevent machining it flat on a table. Normal machining would produce burrs and chips on cell edges, would deflect core and reduce accuracy

Predict Tool and Die Boom for '56

DETROIT—Things are looking better than have in a long, long time for the nation's tool and diemakers. And, sparked by extensive restyling of 1957 automobiles, shop owners look forward to a banner year in 1956. That's the consensus of members of the National Tool & Die Manufacturers Association, gathered here from all over the country for their annual meeting early in November.

New York area shops, it was reported, are doing excellent business, with many working 58 hours a week on diversified jobs, particularly electronics. Chicago, on the other hand, is lagging somewhat behind the industry-leading spectacular business of the Detroit shops, but business is still plenty good and will be even better when Detroit shops overflow.

Frequent Auto Restyling Helps

Shop owners were in wholehearted agreement that the auto industry trend toward restyling every two years instead of every three is a boon to contract job shops.

The tool and die industry, which expects 1955 business to be at least as good as 1954's when final returns are in, will swing along with U S industry as a whole when the automotive industry sparkplugs a nationwide business rise in 1956, Martin R Gainsbrugh, chief economist, National Industrial Conference Board, told the meeting. The current boom differs from past ones in that it is not built on physical shortages, Mr Gainsbrugh said, nor is it built on war, fear of inflation, or federal spending. That's why there is more incentive for private investment.

Specifically, Mr Gainsbrugh predicted a further economic expansion of 2-3% in the first half of 1956, settling onto a plateau in the second half because of political uncertainties, and a possible downturn sometime in the third quarter. But, he forecast, 1956 will be the best year on record if the pattern set by 1955 continues.

Speaking on "Modern Techniques in Automatic Production," Ralph Cross of the Cross Co, Detroit, told assembled tool and die manufacturers that the Air Force is sparking an investigation of the possibilities of tape controls in wing skin-milling. Test setup is currently performing operations 12-14 hours that once took 400-600 hours, he said. It's a short-run setup wherein the machine does all operations on a part with the work in position, instead of being moved through a long sequence of operations, Mr Cross told tool and die manufacturers.

NTDMA's New Officers and Directors

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Field Report USA:

Field Report USA:

Inside the Automation Hearings

We asked Bill Chartener of McGraw-Hill's Economics Dept, who'd spent a couple of days at the recent Senate automation hearings "What did you see and hear that didn't get into the papers?" Here are his random and not-so-random impressions

"Industry witnesses constitute an imposing array (this is Sylvania president and board chairman Don C Mitchell) . . . but they seem to be making no concerted effort like the CIO to 'use' the hearings"

East...

WASHINGTON—It's well along toward the end of the Congressional hearings on automation here on Capitol Hill, but even at this stage there's little evidence of political interest in the question "will automation create mass unemployment?"

Political Indifference

Only one member of the subcommittee, Chairman Wright Patman (D, Texas) has showed up, and only one other, Utah's Republican Senator Arthur D Watkins, has even bothered to send an assistant in to represent him. The subcommittee's other Senator, Wyoming Democrat Joseph C O'Mahoney, is too busy on other matters, although he's the man who instigated the Congressional hearing. Congressman A B Kelley (D, Pa) has been ill, and Rep Jesse Wolcott (R, Mich) apparently has little interest in the hearings, although he comes from the state most affected so far by automation.

Vermont's Republican Senator Ralph Flanders, who is a member of the Joint Committee on the Economic Report but not of this subcommittee, has attended several sessions and has taken an active part in questioning the witnesses. The Senator was once associated with Jones & Lamson Machine Co and obviously knows more about the subject than any of the subcommittee members.

Attendance at the hearings shows low public interest. There are more people at the press table than in the public pews. Could be the low unemployment figures of the last few months have taken some of the steam out of the union's unemployment warnings.

No legislation seems likely to result from these hearings. Purpose of the hearings according to Chairman Patman is "to study the impact of so-called automation on long-run unemployment and investment levels." But any pressure coming from these hearings is unlikely to be either specific enough or intense enough to inspire legislation.

The CIO is making the greatest organized effort to use the hearings as a forum, and a friend on AFL's staff says it's wrong to think AFL cares little about the hearings. But it's significant that CIO representatives include Reuther, Carey and Bierne—all top officials, while AFL's spokesmen are two union chiefs with specific knowledge and interest in the field, but without very high standing in AFL hierarchy. Industry's witnesses constitute an imposing array, but they seem to be making no concerted effort—like that of the CIO—to "use" the hearings.

The unions have made a surprisingly good case for alarm about technological unemployment. They cite recent employment trends in electrical machinery and chemical manufacturing, the telephone and petroleum refining industries, and in manufacturing as a whole where total production worker employment has either declined or hasn't kept pace with output.

Industry spokesmen refute such contentions by (1) appealing to history, particularly the creation of jobs by the automobile, (2) by referring to the whole new "generation" of jobs created by automatic machinery, and (3) by pointing out how the U S economy is being boosted by population and Gross National Product increases.

They're even calling opposition to technological progress "un-American", or at least they're implying it, at the hearings. When a union leader decries the threat of technological displacement by automation, the subcommittee asks if he's against these great advances, and the union man invariably protests he means no such thing. It's gotten to be almost like an oath-taking ceremony—like swearing one is not and has never been a member of the Communist

AUTOMATION HEARINGS
(cont'd)

party or the Ku Klux Klan.

Mass Job Shifts?

One thing stands out at these hearings: fundamental and substantial shifts are taking place in the nature and distribution of jobs. One indication is the failure of manufacturing employment to regain its 1953 peak, even though new records are being set this year. Within the manufacturing group there is an impressive rise in the proportion of non-production workers. Electrical machinery manufacturing is an example: between 1947 and first half 1955 production went up 87%, non-production employment rose 40%, but production worker employment went up only 14%. In that same period, the ratio of production workers to non-production workers in the chemical industry went from 3 to 1 in 1947 to 2 to 1 in 1953.

If there's any lesson or moral to come out of the hearings it's this: there's a serious need for education and retraining in scientific and technical occupations.

Take a Crack at Red tape?

WASHINGTON—Businessmen are invited to take a crack at their pet red-tape tie-ups, if they are connected with federal requests for statistics or other information.

The Advisory Council on Federal reports, taking a cue from the Hoover Commission, is setting up committees to check on the ferro-alloy and machine-tool industries, and procurement and renegotiation practices.

In addition, the council will accept examples of what business may consider excess paperwork if it falls into any of three categories:

- Questions that should be reworded
- Duplicates of other gov't requests
- Questions that don't lead directly to the information actually desired.

Criticisms can be sent to the council at 1001 Connecticut Ave NW, Wash 6 DC.

Eastern newsnotes . . .

Crucible Steel Co of America's tool steel seminar at Pittsburgh drew 400 engineers and operating men October 25 to hear Crucible metallurgist Charles McShane on "Tool Failures and Causes and How to Avoid Them," and a related film and panel discussion . . . **U S Industries Inc,** New York, has taken over **Southern Pipe & Casing Co,** Azusa, Calif, maker of welded steel water, oil and gas transmission pipe . . . **American Radiator & Standard Sanitary Corp** is dissolving its **Kewanee-Ross Corp** and remaking it into two ARSSC divisions: **Kewanee Boiler Division,** making boilers, and the **Ross Heat Exchanger Division,** making heat exchangers, surface condensers and similar products. W B Russell, ex-Kewanee-Ross president, heads the former division, and K-R vp E M Palmer the latter . . . **Jacobson Nut Mfg Co** has broken ground for a new plant at Mark Rd, Kenilworth, N J, says this will make Jacobson the world's No 1 exclusive nut manufacturer . . . **Walter Kidde Constructors Inc,** New York, was the first stop for a German team of plant layout experts on a five-week tour of the U S . . . **Baldwin-Lima-Hamilton Corp** reports its first-nine-month orders for this year are 85% ahead of 1954 for the same period, plans to set up an **Electronics and Instrumentation Division** in Boston . . . **Westinghouse** says its third quarter sales and earnings dropped off because of the long IUF-CIO strike . . . **Industrial Diamond Association of America** has moved out of New York to offices in Pompton Plains, N J.

Up in New England . . .

Twice-flooded **Farrel-Birmingham,** Ansonia, Conn, has still found time to acquire the **Press Division of Watson-Stillman Co, H K Porter Co** subsidiary, including engineering and sales divisions, patents, drawings, jigs, fixtures, etc—everything except Watson-Stillman's Roselle, N J, plant . . . **Bridgeport Brass Co,** Bridgeport, Conn, is celebrating its 90th birthday, and it's 90 years without a serious labor dispute! . . . In spite of $180,000 damage in the August floods, **Van Norman Co,** Springfield, Mass, reports 40-week earnings of $997,809—a sharp rise over comparable 1954's $295,867 . . . Massachusetts manufacturers report an increase of 3.7 generally in volume of new orders received in September over August. On the **Associated Industries of Massachusetts** Index (1947 = 100) machinery output (except electrical) rose to 132.2 from 114.8 and fabricated metals dropped to 153.8 from 161.1 . . . **Van Norman Co** is buying out **Insuline Corp of America,** Manchester, N H, electronics firm, as a diversification move . . . **O S Walker Co Inc,** Worcester, Mass, will manufacture and merchandise Rawson couplings, formerly made and sold by **Worcester Polytechnic Institute's Washburn Shops.**

South . . .

Southeastern Notes . . .

Newport News Shipbuilding & Drydock Co is now working on installation of the first open-cycle, gas turbine installation aboard war-built Liberty ships. Under a maritime contract, the yard is installing the new power plant and making extensive hull modifications to modernize the vessel. If maritime plans work out, the entire obsolete Liberty ship fleet may be brought back into useful service. New designs will up speeds from present 10 knots to 16 knots. . . . **Newport** has also been awarded contracts for two new 715-foot tankers for Esso. Ships will be capable of 18.5 knots and have a deadweight tonnage of 35,420 . . . Primary and fabricated metals industries were responsible for pushing total manufacturing employment in the Southeast almost up to 1953's peak, and payrolls considerably above that point. Average weekly earning for primary metals workers in area, particularly Alabama, is $86.64 compared to $75.83 a year ago . . . Tennessee is losing industrial workers at a rate termed "shocking" by the industrial development commission. More than 106,000 workers were placed in out-of-state jobs during 1951-1954 by federal agencies. An estimated three times that number were left on their own . . . Atlanta will be the scene of an **International Industrial Exposition** to be held next May. Idea will be to sponsor international trade out of Atlanta, hence exposition will be held for commercial buyers, not open to public . . . Stockholders of the **Denison Corp,** North Miami firm making aluminum jalousie windows and doors and aluminum awning windows, have approved sale of the corporation's

Field Report USA:

assets to **Stanley Works,** New Britain, Conn, for $1,335,678. Denison's name will be changed to **Stanley Building Specialties Co,** and it will be operated as a subsidiary.

Midwest...

Rebellion in the ranks . . .

DETROIT—Meeting here November 6, more than 400 disgruntled craftsmen brought to a steaming head their dissatisfaction with treatment accorded skilled trades workers in the UAW-CIO. The 400 voted to apply to the National Labor Relations Board for independent union status as the Society of Skilled Trades. The group, already organized on a county-by-county basis in Detroit and Flint, claims more than 40,000 card-carrying members.

Maintaining that the Taft-Hartley Law has never been properly challenged on the right to form a union of members who are (at the moment) under obligation to honor a prior contract, the Society plans to challenge NLRB's policy that present UAW-CIO contracts must be fulfilled. New union elections can be held in plants under UAW-CIO contracts in force until 1958.

Executives of the Society claim a move is underway to formulate a branch in Cleveland, and from there to branch out all over the country.

"Comparing themselves with the rebels who fought against taxation without representation in early American history," the Society lashed back at charges reportedly made by UAW-CIO that the splinter group is "communist-dominated."

"We are not communist-dominated," one speaker said, "and we do not say that Reuther and his group are commies—but we do say they have adopted the basic techniques of communism—they have lied so often and so long that they cannot do anything else but lie now."

Among the new union's first moves: "proper recognition" of the skilled trades group via a wider salary spread between skilled trades and the production workers; separate bargaining rights for all skilled men; taking pensions out of the hands of companies and into the hands of the union; stopping influx of new trainees (upgraders); "unlimited quantities are provided in the UAW/GM contract, thereby overloading the trade."

UAW has suspended several members suspected of holding membership in the Society. Members from Flint, where it was organized, told Detroit men to look forward to a "program of intense coercion, threats, and outright discrimination" on the part of UAW-CIO.

UAW-CIO asserted flatly that it has severed all splinter group members from the UAW—a measure which means that the members so severed are out of their present jobs.

Detroit Briefs . . .

Udylite Corp will build a "factory building" in northeast Detroit on Hoover Rd that will have 160,000 sq ft of manufacturing area, and 8000 sq ft of office space . . . **Plymouth Division** of **Chrysler** is taking over administration of Chrysler's Evansville body plant from the Automotive Body Division . . . **Bunting Brass & Bronze** of Toledo has bought out **Detroit Sintered Metals Corp,** no change in management or output . . . **GM's Detroit Transmission Division** has just turned out its 7-millionth Hydra-Matic . . . Wesson Co is opening a new division in Toronto, **Wesson cutting tools, Ltd** . . . **Chrysler** has bought out **Universal Products Co** and its subsidiary, Formetal Co, for about $3.5 million . . . **Wesson Co** has dropped price of holders for throw-away carbide inserts an average of 32%.

In Ohio . . .

National Acme says its well-distributed backlog will carry the company through first half 1956 at current operational capacity . . . C H Ker of Dalton, Ind, has been elected president of the **Gray Iron Founders' Society,** Cleveland . . . **Ferro Machine & Foundry Co** has acquired **Falls Welding & Mfg Co,** Newton Falls . . . Bill Jack and Ralph Heintz, famed WWII owners of **Jack & Heintz,** have been given a clean bill of health by U S courts on charges of a $5-million tax deficiency . . . Cleveland's **Arthur G McKee Co** will build **U S Steel's** biggest sintering installation at USS's Fairless Works. Rumored cost: $5 million . . . **Cleveland Cap Screw Co** and **Standard Pressed Steel Co,** Jenkintown, Pa, are merging to make the combine a giant in the metal fastener industry . . . Fletcher Gleason, ex-Lees-Bradner division manager, heads a Cleveland combine that has acquired **Ohio Moulding Co** . . . **General Motors** is buying **Martin-Parry Corp's** Toledo plant, will use it to make Chevvy automatic transmissions . . . 55-year-old **Columbus Anvil & Forging** is undergoing the auctioneer's hammer . . . **UAW-CIO** has signed a three-year contract with **Unitcast Corp's** three Toledo plants for 6-14¢ an hour pay boosts plus fringes . . . **Toledo Pipe Threading Machine Co** has acquired **Thred-Ezy Co,** maker of Port-A-Pony portable power drives . . . **Oster Mfg Co** is entering the materials handling equipment field, will make and market a line of hand and battery operated portable lifts up to 2000-lb capacity . . . **Diebold Inc** of Canton has bought out **K F Cline Co Inc,** Dickson, Tenn, makers of school and office lockers . . . **Thompson Products** upped its first nine-months sales $10,984,972 to $214,478,664 this year over last year. Big gain was in automotive parts sales . . . **National Malleable & Steel Castings Co,** Cleveland, in the same period shot sales up from $27 million to $42 million . . . A new firm, **Production Machinery Corp,** Mentor, Ohio, will make job-engineered machinery for steel processing . . . **McKey Machine Co,** Youngstown, is spending $750,000 to increase its output 25%. Plans include a $135,000 plant addition and a new shop in a leased building . . . **East Akron Casting Co** is moving out of the right-of-way of the Ohio Expressway . . . **Warner & Swasey** is jubilant over a marked increase in inquiries for its textile loom. Looks like textiles are coming back to life at long last . . . **Clevite Corp** has changed the name of its recently acquired **Wallace Aviation Corp** to **Clevite Aero Products Inc.**

West...

Around the SF Bay Area . . .

Food Machinery and Chemical Corp, San Jose, has brought out a quarterly report that shows greatest growth volume of any third quarter in its history. Consolidated billings for third quarter 1955 topped $66 million —a 12% boost over third quarter '54. Gross volume for first nine months was more than $204 million —a 16% hike over the same period last year. Regular machinery lines accounted for 35% of volume the first nine months, with national defense production supplying 17% and chemicals the remainder . . . **North American Aviation's** Fresno Division an-

nounced delivery November 4 of its 1000th airplane under Air Force modification contracts. The Division has a $24.5-million backlog . . . **Columbia-Geneva Steel Division** of **U S Steel** has announced revision in size extras for hot-rolled carbon steel wire rods in sizes 35/64 in. and smaller. Effective October 29, prices went up $1-$4 per ton in these sizes . . . West Coast shipbuilding is at the lowest ebb in 37 years, a local industry spokesman testified at a Senate hearing October 31 in San Francisco. Local shipbuilding firms are being forced into non-marine work to survive, said one witness . . . Metalworking firms in the Bay Area with recently announced expansion plans: **Tempo Vane Mfg Co** and **Peerless Electric Co,** San Francisco; **NuWay Harvester Co, Bradford Mfg Co** and **Continental Can Co** in San Jose; **Olin Mfg Co,** Oakland; **Vargas Welding,** Centerville; **American Radiator & Standard Sanitary Corp,** San Pablo; **Superior Electro-Cast Foundry Co, Colorado Fuel & Iron, Borba Mfg Co** in South San Francisco; and **Insul-8 Corp,** San Carlos.

LA Area Briefs . . .

North American Aviation moved 870 employees into the completed portion of its new $3-million Propulsion Development Center at Canoga Park, Calif, during the first half of November. Moving day for 1700 other employees from NAA facilities in Los Angeles, Beverly Hills and Canoga Park will come after the manufacturing area is completed in late December . . . **Pacific Airmotive Corp** has informed stockholders that operations during the first nine months of current fiscal year have resulted in a $717,072 net loss. Principal reason is a disputed Air Force contract for overhaul and modification of C-54 aircraft at the Chino, Calif, Division. According to the company, the Air Force believes certain additional work should be done without contractual coverage. Negotiations on the dispute are still in progress . . . **General Controls** rang up sales for the first nine months of this year that topped the entire year of 1954. Sales for nine months ended September 30 totaled $19 million, compared with $13 million for the corresponding part of 1954. The company expects fourth quarter sales to be even higher, bringing gross sales for the year to $27 million, which would be an all time high.

President Walter K Bailey

Board Chairman Charles J Stilwell

Warner & Swasey Celebrates 75 Years of Machine-Tool Building

CLEVELAND—It's three-quarters of a century since two New England farm-boys-turned-machinist pooled their talents and their fortunes — $2500 apiece — to form what is today the world's largest maker of turret lathes, and a firm to be reckoned with in any roster of the world's major builders of machine tools. In celebration of its 75th anniversary, Warner & Swasey Co invited its almost-3000 employees and their families, including 475 from the New Philadelphia, Ohio, plant, to inspect the main plant in Cleveland on October 29 and October 31.

Today's huge Warner & Swasey Co, with its subsidiaries and diversified operations, is a far cry from the original Cleveland setup at Carnegie Ave and 55th St, then known as Wilson Ave. The Cleveland location was W & S's second home — the first was in Chicago in 1880, where lack of skilled help in what was then virtually an industrial frontier town, forced the back-to-Cleveland move.

W & S turret lathes caught on from the very first, particularly with manufacturers of pistols and rifles. From small-arms output, W & S turret lathe output was upped to meet demands of new industries, like sewing machines, plumbing (indoor), steam generators, railroad steam engines, farm machinery, bicycles, and the whole new industrial era created when Henry Ford introduced mass production.

The turret lathe has been the keystone of Warner & Swasey's business ($40-million overall sales this year), but along the 75-year way W & S has expanded and diversified in many ways. One of the most interesting sidelights is the making of telescopes, started in 1881 and climaxed with building McDonald Observatory's 81-incher in 1939.

With World War II and tremendous demands for turret lathes, W & S greatly expanded its plant. When the war was over, the company had to diversify or shrink back operations to normal levels. It chose the former course, and has since branched into manufacture of other machine tools, of textile machinery, and of the Gradall earthmoving machine. In 1954, W & S acquired Industrial Scientific Co, and is now negotiating to buy the Duplex Truck Co of Lansing, Mich, maker of undercarriages for the Gradall.

During the open house, visitors had a look at the plant demonstration room, where W & S's entire line as presented at the Machine Tool Show was on display. A circus tent was the scene of a special program of entertainment and presentation of awards to employee old timers by Board Chairman Charles J Stilwell (scrolls for 50-year people, gold watches for 25-year men). The 50-year award, to Stephen Lawson, is likely to be the last because of Warner & Swasey's new retire-at-65 pension plan.

What about Warner & Swasey today? President Walter K Bailey told employees and guests at the open house: Full capacity rate of production . . . achieved during the final quarter of 1955, should continue at least through the first two quarters of 1956."

Yale & Towne Manufacturing Co appointments . . **Elmer F Twyman** (left), general manager of the Materials Handling Div, to vice president and director; **John A Baldinger** (center), general manager of the Automatic Transportation Co Div, to succeed Mr Twyman; and **Roy L Wolter**, midwest regional sales manager of industrial trucks, to take over Mr Baldinger's post

Names in the News . . .

H Charles Yaeger has been appointed manager of manufacturing at Borg-Warner Corp's Pesco Products Div, Bedford, Ohio. He was previously factory manager of Jacobs Aircraft Engine Co, Pottstown, Pa.

Jerome F Ferdinand, former vice-president, sales, of Wales-Strippit Corp, has joined Punch Products Corp, Niagara Falls, NY, as sales manager.

Albert H Clarke, commercial vice president of Crouse-Hinds Co, Syracuse, NY, has been named vice president, engineering. He succeeds **Carl H Bissell,** who is retiring after 53 years of service.

William C Osborne has been promoted from assistant to manager of engineering, of Worthington Corp's Harrison Div. **Everett C Schmachtenberg,** chief engineer of the compressor engineering department, succeeds Mr Osborne.

Goff Smith, executive vice president of Griffin Wheel Co, subsidiary of American Steel Foundries, has been elected president; he succeeds **Edmund Q Sylvester,** who has resigned.

Harvey Bertrum Wilgus, formerly sales manager of Redmond Co, Owosso, Mich, has been appointed general sales manager of Electric Products Co, Cleveland.

D M Hallier, manager of Motch & Merryweather Machinery Co's Cutting Tool Manufacturing Div, has been named manager of cutting tools, directing operations of both the Cutting Tool Distributor Div, and the Manufacturing Div

Warren G Rosendahl, formerly associated with Lodge & Shipley Co, has been appointed vice president and sales manager of Nebel Machine Tool Corp, Cincinnati

Arthur M Swigert has been appointed works manager of Chrysler Corp's Detroit Universal Div. He was formerly vice president, manufacturing, of Universal Products Co, recently acquired by Chrysler.

Gerard Q Decker, formerly associated with Rheem Manufacturing Co, has been appointed manager of Servomechanisms' eastern division at Westbury, NY. He succeeds **Harold E Carlson,** named program controller.

John N VanEpps has been appointed vice president of manufacturing of the affiliated Madison Manufacturing Co, Muskegon, Mich, and Madison Industries, Inc, Big Rapids, Mich. Prior to joining the cutting tool organization, Mr VanEpps was manager of contract sales for the Universal Winding Co.

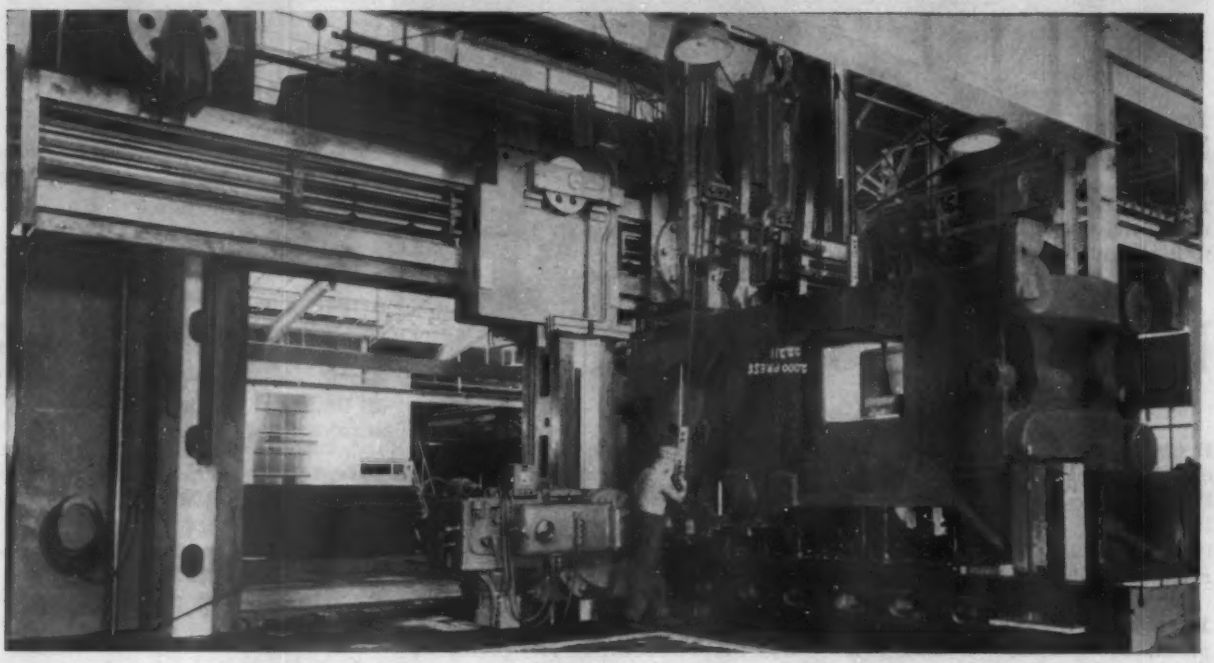
Edward F Lickey, recently retired manager of Motch & Merryweather Machinery Co's Detroit office, has been appointed consultant to the Metalworking Equipment Division of the Business and Defense Services Administration.

Donald N McPherson has been named general manager of Willey's Carbide Tool Co, Detroit.

OBITUARY

Frederick E Munschauer, Sr, 70, president and general manager of Niagara Machine & Tool Works, Buffalo, NY, died Oct 22. Mr Munschauer, active in the machine tool industry for nearly 50 years, was responsible for many developments and improvements in mechanical presses, shears, and other sheet metal fabricating machines.

New Shop Equipment,



Housing Moves to Change Planer Width

Planing castings for the world's largest forging machines is the job of this versatile Niles 23-ft planer (see cover) for National Machinery Company, Tiffin, Ohio. A convertible unit with a movable auxiliary housing, it combines the rigidity and accuracy of a double-housing planer with the convertibility feature. It has a capacity of 15 ft under the crossrail, maximum width of 23 ft, minimum width of 13 ft and a planing length of 24 ft. A double-housing unit with an adjustable auxiliary left-hand housing, the planer is equipped with two planing heads on the crossrail and two side heads, with one side head mounted on the auxiliary housing. Planing speeds range from 3.4 to 102 sfpm. National Machinery engineers say they can plane any casting whose width and height permit it to be shipped on a flatcar.

Rail width is 41 ft, and over-all height 28 ft 7⅝ in. above the floor line, the auxiliary housing 18 ft below floor line. Each rail planing head is equipped with pendant controls. Pendant stations have a feed-traverse selector switch, a feed jog button, an "up-right, down-left" selector switch, a rail-head-feed start and stop button, an inching cut and inching return buttons for the main drive, and an automatic cut and automatic return main drive button, with a stop wobble stick mounted on the bottom of the pendant station.

All head slides are cast steel, giving 60 in. of travel instead of the usual 48 in. possible with cast iron. All gibs for heads are bronze instead of cast iron, eliminating the problem of pickup. The table itself has plastic wear plates on the ways.

Rail heads have rapid traverse in all directions and power and hand feed for cross, vertical and angular travel. Tool slides and clapper boxes have independent swivels with swivel adjustments made through a worm gear p rion, and a rack segment at the top of each member. Side heads too have power and hand feed for vertical, cross and angular travel, and rapid traverse in all directions.

Instead of a full 22-ft-width table, this table is 12 ft wide. This permits the operator to make a single setup to work three sides of a job that is not full width. With a wide table, it would have been necessary to make a second setup to do the machining on the left side.

For an extra-wide workpiece, National Machinery has an auxiliary track or rail running parallel to the table. A car riding on the track supports the overhanging section. Adjustability of the left-hand auxiliary housing and planing head is one of the most important design features. It is this auxiliary housing that gives the machine its great flexibility. Located between the left-hand stationary housing and the table, the auxiliary housing is supported at the top and bottom by saddles dovetailed to the crossrail and to the lower auxiliary rail.

The table has three tracks on the bed—a V way in the center, and flat ways on either side. All three tracks have nonmetallic wear plates.

Horizontal power adjustment is

Materials and Parts . . .

FLOOR-MOUNTED OPERATOR STATION includes load-indicator main-drive ammeter; pushbutton controls for rail and auxiliary housing; selector rheostats; stop and start buttons for the tool lifter. The planer has two rail-head pendant stations, one floor-mounted and two side-head control stations

CLOSEUP OF TOOLHOLDERS AND PENDANT controlling the right-hand crossrail head. The operator is standing in the casing mounted on the table. Rail heads have rapid traverse in all directions; power and hand feed for cross, vertical and angular travel

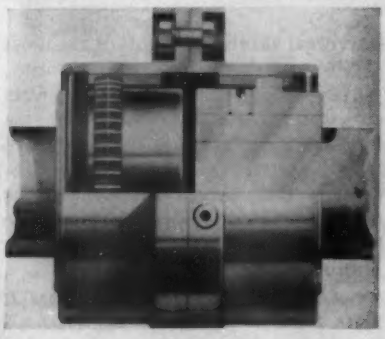
provided by two traverse screws, one in the lower auxiliary rail.

The machine is driven by 100-hp, variable-voltage, 40 to 1200 rpm, reversing motor. The 100-kw generator is driven by a 150-hp, 220/440 volt, 3-phase, 60-cycle, 1800-rpm motor. Other motors include a 40-hp motor for rail elevating, a 7½-hp motor for feed and traverse for each of the four heads; various other motors for rail clamp, auxiliary housing traverse, table-drive and table-track and feedbox lubricating pumps.

The main drive motor is below floor level on the right side of the machine facing the crossrail. The deep pit for the auxiliary housing on the left side of the machine made it impossible to locate the motor in the normal position.

Major contributing factor in the rigidity of the machines is the foundation, which goes down to bed rock. Almost 500 cu yd of concrete went into the foundation.

Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Penna



Ajax Coupling Handles 3° Misalignment

Series 3D dihedral coupling is designed to handle misalignment up to 3° between driving and driven shafts of direct-connected machines. Teeth are designed to permit close tooth clearance and no end-of-tooth wear.

Couplings are designed for NEMA motor shafts using standard keys.

Ajax Flexible Coupling Co, Westfield, NY

...including

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WEAR on a carbide tool, left, and on a cemented-oxide tool, the latter mechanically clamped. Oxide tool is supported on a carbide shim and is provided with a carbide chip breaker. Carbide tool made only a half cut on 7-ft-dia chrome-moly steel (220 to 240 Brinell) turbine wheel hub. Cemented oxide tool was used for two additional cuts—one of them on the face of the wheel's OD

INDENTATION made in determining hardness of cemented oxide, top, indicates material has slight ductility, compared to typical ceramic, below. Conventional ceramic materials chip or flake away

Carboloy Cemented Oxides To Be Commercially Available Jan '56

According to Carboloy engineers' initial spot tests, these new cemented oxides—so called to distinguish them from typical ceramic materials and formed by powder-metallurgy techniques—may be successfully used for finishing operations at the top speed range of machine tools currently in use. Performance, however, is considerably better at speeds of 1000 sfpm and higher, even speeds of 7500 sfpm, than at lower speeds. This material together with instructions for its application will be available to users on a limited basis by Jan 1, 1956.

In one test, cemented oxide was used to finish-turn the OD of the wheel on the shaft end of a gas turbine. The material was SAE 4340 steel hardened to 260 Brinell. Carbide is normally used and the work is turned at 250 sfpm. For the cemented-oxide tool, machine speed was increased to 300 sfpm. At the same depth of cut and feed as used with carbide the oxide tool showed negligible wear after making a 3/16-in. cut on the 16-in.-dia wheel. Results were equally good at 0.125-in. depth of cut, 0.010-in. feed, and a speed of 485 sfpm. The tool life of carbide would have been considerably shortened at this accelerated speed.

In another test reported by Carboloy, cemented oxide provided a wear life better than 25 to 1 over carbide. The piece was a 5 3/4-in.-dia SAE 1045 steel motor shaft (170-210 Brinell) run dry at 900 sfpm with a depth of cut of 0.100 in. and a feed of 0.005 ipr. A 111-in.-long cut was made in 36.5 min. Tool wear was 0.005 in. Tool geometry was 15° for end-cutting-edge angle and lead angle, 1/16-in. nose radius, and 6° relief angle. Both the cutting edge and the land were honed—the former 0.002 to 0.004 in. and the latter 0.025 in. Carbide normally used on the job under the same conditions ran less than ½ min. and provided a cut of only ¾ in.

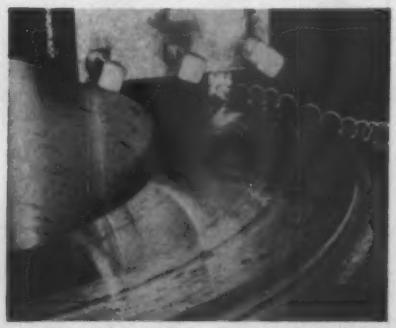
Currently used with mechanical holders, tips of the new material are said to machine not only materials such as SAE 1045 and softer steels, but also SAE 4340 and nickel-chrome-moly steels with Brinell hardness to 300 (photo, left).

Although no coolant is required, the material may be used with coolants if heat deformation of the work is a factor. The tool material does not heat to any important degree and is generally cool to the touch following a machining operation. There is no sign of chip welding or build-up on the tool edge. The material has some inherent lubricity.

So far as is now known, cement-oxide tool tips can be wet-ground with 220-grit diamond wheels. Use of finer grit is possible but grinding takes longer. Silicon carbide wheels have been used for rough grinding only. Honing, at the cutting edge and nose radius, is essential.

The new material presents the same difficulty of classification in conventional material categories as did cemented carbides when they were first introduced. This material has a two-phase structure; contains no metal. It has a transverse rupture strength of 80,000 to 100,000 psi, density of 4.10 to 4.20, and hardness of R_A 93 to 94, only a couple of points harder than carbide. Resistance to oxidation is very good, as is corrosion resistance in general. These qualities suggest a variety of applications other than cutting tips.

Carboloy Dept, General Electric Co, Detroit 32, Mich

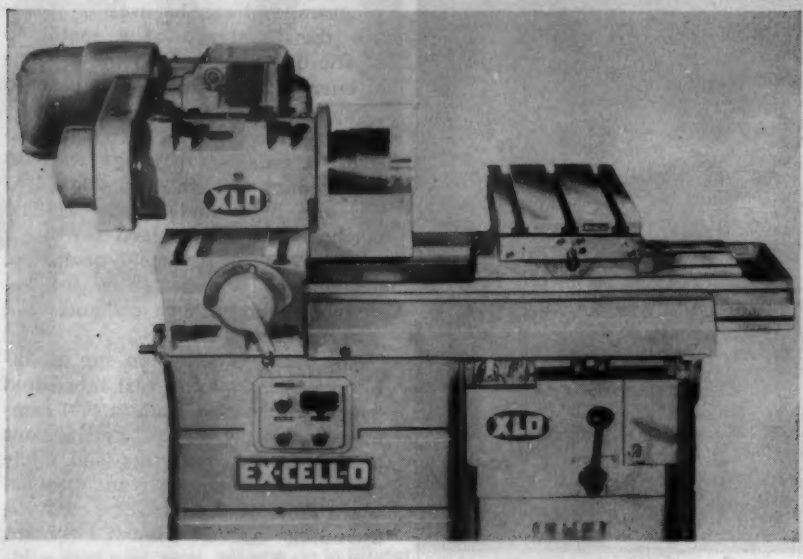


CHROME-MOLY HUB is machined at 500 sfpm with 0.040 in. depth of cut and 0.011 ipr feed with cemented-oxide tool. Resulting surface appears to have been ground. Rougher surface resulted from carbide tool at much slower surface speed

Universal skiving toolholder for most single and multiple spindle automatics and turret lathes permits adjustment of tool to any diameter within machine capacity. Feeds are said to be increased by 100%; extremely long pieces with small dias may be formed; closer tolerances are held; many secondary operations are eliminated.

Lincoln Machine Parts Corp, 732 E 144th St, New York, NY

Ex-Cell-O Boring Machine Handles Precision Work



Designed to accommodate small and medium size workpieces, Model 2112-B is single-end unit with 12-in. table travel. Wide variety of table feeds and speeds is provided by hydraulic control panels. Adjustable dials control feed rates in both directions of table travel, and automatic compensating pressures assure smooth table movement.

Heavy nickel-iron casting is used for the base. Standard features include fast rapid traverse, spindle brakes, permanently lubricated spindles, and automatically lubricated ways.

Machine can be set up for production work with controls locked for continuous reproduction to close limits.

Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich

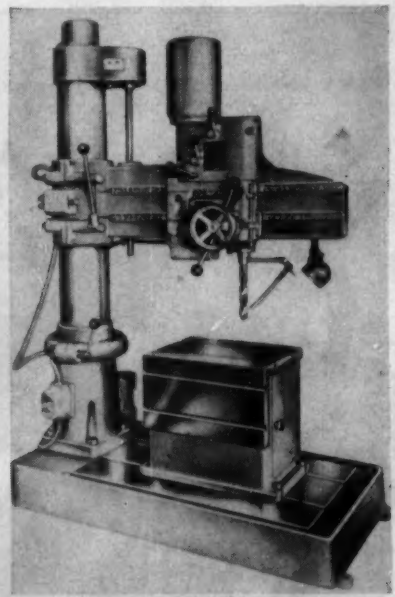
Ultrasonic Solder Pot For Fluxless Tinning, Dipping

Alcar fluxless 3-in. solder pot is designed for tinning and dipping of small parts. Unit stands 10¼ in. tall. When desired, the unit can be used as ultrasonic mixer/cleaner by disconnecting the heating element, being useful for such operations as blind-hole cleaning, degreasing, and the like.

Unit may be operated from either 30- or 100-watt Alcar generator.

Alcar Instruments, Inc, 17 Industrial Ave, Little Ferry, NJ

SPRINGS ARE HOPPER-FED with this Peeco vibratory feeder. Device is said to accommodate parts from 0.040-in. lamp filaments to 3.0-in. industrial springs, at predetermined speed. Multiple selectors reject parts not properly located (see insets). Technical literature available — *Perry Equipment & Engineering Co, 3125 Brandes St, Erie, Penna*



Radial Drill Has 2-hp Motor

Masters radial drill with direct-gear drive, 2-hp motor has a No. 4 taper in the spindle with a drilling capacity of 1¾ in.

A drill ejector on the spindle permits drills to be removed without the use of a drift punch.

Distance from the column is 40 in. Drillhead moves on dovetail with roller bearings. Brochure available.

Masters Precision Tools, 3613 Archer Ave, Chicago 9, Ill

Monarch Machinability Lathe For Metal-Cutting Research

Machinability test lathe was designed especially for research in metal cutting conditions. Machine has infinitely variable speeds from 625 to 3775 rpm, powered by 20-hp variable-speed motor. Higher speeds are possible with special pick-off gears. The lathe is an outgrowth of Monarch's metal-cutting research program, and can be used to measure the resistance of a metal to plastic deformation and the amount of energy converted to heat, and to compute normal tool wear.

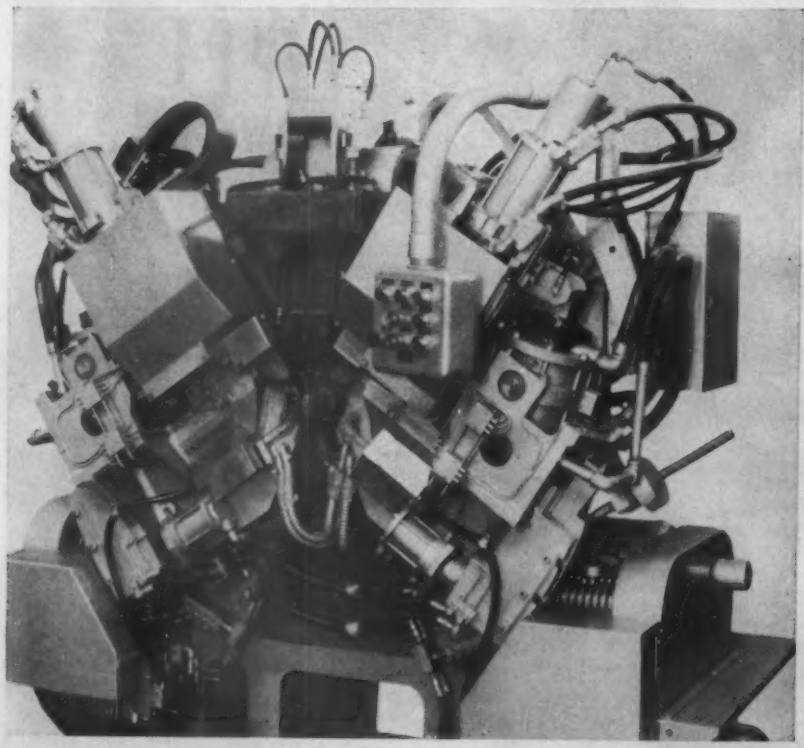
These results are then used to select a balanced cutting condition for production with economical tool life and high surface speeds. The machine is also designed for study of special tools and tool geometry, for material control, and for research in new alloys, coolants, and other materials.

The lathe is based on the Mona-Matic series, with mist-lubricated headstock which has a 6-in. A-1 camlock spindle. Carriage and aprons are reinforced, and cross-feed, cycle control, and tool relief are optional when needed. All operating controls, including speed control, coolant pump, and start, stop, and free spindle controls, are apron-mounted.

Tailstock is mist-lubricated, with anti-friction, air-operated motor. Coolant pump is standard equipment.

Clearance diameter is 15 in., with swing over the compound of 8 in. Machine is supplied without instrumentation, so the user may select the test instruments needed for his particular test program.

The Monarch Machine Tool Co, Sidney, Ohio



BOTH ENDS OF STRIP STEEL are resistance-welded to forging to make automatic transmission bands for automobiles in this double-end welder. Welds are said to be same cross-section as band, and no special preparation of forging is done to make welded joint. After welding, the joints are broached free of flash, forging is severed, and machined to complete the part. Machine is said to be adjustable for many band sizes and forging shapes — *The Taylor-Winfield Corp, Warren, Ohio*

Glass Powder Molds For Precision Metal Casting

Corning's Glascast powder is 96% silica glass compound which is vitreous rather than crystalline, so that it has uniform thermal expansion and is not subject to abrupt volumetric changes. Molds made from powder can be used to cast aluminum, bronze, and alloy steels at temperatures as high as 3300°F, according to manufacturer.

Molds are prepared by pouring slurry of four parts Glascast powder to one part water into porous plaster mold of part to be cast. Porous plaster absorbs water, leaving silica glass shell which is then removed and fired for ½ hr at 1740°F to 1920°F. For metal casting, glass mold halves are clamped together using any conventional technique.

Corning reports that Glascast molds produce 40 to 50 mu-in. finish with no pitting, that dimensional variation can be held within ±0.005 in. Molds are used only once, except for metals like aluminum and castings of simple, shallow-draw shapes.

Corning Glass Works, Corning, NY

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 AUTOMATIC TURRET LATHE — *Potter & Johnston Co, Pawtucket, RI.* 12-page bulletin 150 describes 6DRE-40 and 6DREL-40 (18 and 26-1/2-in. turret travel) with 40-hp headstock; 4 automatic speed changes; spindle speed range 23 to 470 rpm. Design features and tooling illustrated; specifications and applications included.

2 MACHINE TOOLS—*Cincinnati Gilbert Machine Tool Co, Cincinnati 32, Ohio.* Illustrated condensed catalog covers table and floor-type horizontal boring mills, rotary tables, auto-positioner, and 3, 4, and 5-in. radial drills. Supplemental data sheets 555 and 955 give details on 4-in. 4-1/2-in. boring mills.

3 MILLING MACHINE — *Pratt & Whitney, West Hartford 1, Conn.* 4-page circular 590 contains illustrated description of Velvetrace automatic unit for 3-dimensional traced-controlled reproduction; spindle speeds from 310 to 10,800 rpm. Operational data and specifications included.

4 NOTCHING MACHINES—*V & O Press Co, Die Emhart Mfg Co, Hudson, NY.* 16-page catalog 55 illustrates and describes press and fixture specifications for three notching machine models, two types of segment notchers, a slotting unit, and a band punching machine. Attachments illustrated.

5 TRACER LATHE—*Hydra-Feed Machine Tool Corp, Ferndale, Mich.* 4-page bulletin HDT-55 contains data on copy turning with unit that incorporates top mounting of both tracer slide and templet. Choice of constant or variable speed drives; design features illustrated; specifications tabulated.

6 FACE MILL GRINDERS — *Oliver Instrument Co, Adrian, Mich.* 12-page bulletin illustrates and describes complete line. Specifications, construction features on automatic hydraulically operated units with 6 to 16-in. face mill capacity, 8 to 18-in., and 10 to 21-in.; heavy-duty hand-operated model with 4 to 24-in. cutter capacity; No. 2 are radius cutter grinder for sharpening face mills 6 to 26-in. dia.

7 HYDRAULIC PRESSES — *Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.* 12-page bulletin 3201 contains illustrated information on line of metalworking presses. Range of applications, typical installations, specifications. Tabular engineering data includes table of capacities for press rams from 1 to 60 in. in dia.

8 ROTARY SURFACE GRINDERS—*Arter Grinding Machine Co, Worcester 5, Mass.* 4-page illustrated bulletin covers Model E hydraulic unit in 12 and 16-in. sizes. Additional 4-page folder illustrates mechanically operated Model F with 12-in chuck capacity. Features and specifications of both covered.

9 METAL CUTTING BANDSAWS — *Wells Manufacturing Corp, Three Rivers, Mich.* 8-page illustrated catalog G-55 contains descriptive data and specifications for complete line, capacities from 8-1/2 x 6 in. up to 12 x 16 in.; accessories described. Blade and speed selection chart for cutting various materials included.

10 "PROFIT FROM PRESSES"—*Diamond Machine Tool Co, Pico, Calif.* 20-page catalog illustrates case history punch press applications in 24 plants operating Multi-Max open-throat presses. Wide variety of applications presented.

11 INTERNAL GRINDING EQUIPMENT—*Bryant Chucking Grinder Co, Springfield, Vt.* 8-page illustrated folder describes Series 800 high-frequency wheelheads; technical data, and information on alternators and hi-frequency motors. 4-page bulletin covers automatic sizing, illustrating Bryant air sizing, solid plug sizing, and diamond sizing with schematics. Third folder describes new process controller which provides statistical quality control for accurate, uniform production.

TOOLS AND ACCESSORIES

12 POWER TOOLS — *Boice-Crane Co, Toledo 6, Ohio.* 51-page illustrated catalog covers tools for cutting, shaping, drilling, and finishing wood, metal, fiber and plastics. Descriptions and specifications on planers, bandsaws, lathes, shapers, saw jointers, etc.

13 "MEASUREMENT OF VIBRATION"—*General Radio Co, Cambridge 39, Mass.* 64-page booklet covers terminology, description of vibration-measuring instruments, procedures, typical examples, interpretation of results. Section included on human response to mechanical vibration.

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14 DIAL GAGES & SETMASTERS — *Boice Manufacturing Co, Staatsburg, NY.* 16-page illustrated bulletin 55, plus price list and ordering information, gives descriptions and specifications of snap, bore, ID, OD, depth, length gages, and corresponding setmasters.

15 MULTI-DIMENSION GAGING MACHINES—*Pratt & Whitney, West Hartford, Conn.* 11-page circular 592 contains illustrated data on Sigmatic units for in-process gaging and final inspection. Purpose, advantages, construction features, operational details, available models, and applications.

16 GRINDING WHEEL SELECTION FOR TOOL AND CONSTRUCTION STEELS—*Norton Co, Worcester 6, Mass.* 22-page illustrated booklet covering selection data contains tabular data on classification and nominal composition of principal types of tool steels, grindability values, wheel recommendations, constructional steels (soft and carburized).

17 MACHINE TOOL ACCESSORIES—*Beaver Tool & Engineering Corp, Royal Oak, Mich.* 50-page catalog 55 illustrates and describes quick change holders and adaptors for end mills, shell and face mills, drills, reamers, and tools; also arbors, spacing collars, sleeves, boring heads, inserted blade mills. Includes engineering data, design information for quick-change tooling applications.

18 HI-SPEED STEEL MILLING CUTTERS—*Goddard & Goddard Co, Detroit 23, Mich.* 51-page condensed catalog 2 contains indexed illustrated information on end mills and holders, form cutters, plain milling cutters, saws, slotting cutters, straddle milling, T-slot, and Woodruff keyseat. Dimension tables and price list.

19 MICRO-DRILLS — *Louis Levin & Son, Inc, Los Angeles 7, Calif.* 4-page bulletin Q describes Sphinx precision tools for instrument work and automatic screw machines. LH and center drills have been added to the line. Spiree type is available up to 3.00 mm (0.1181 in.).

20 PORTABLE TESTER FOR SHEET METAL — *Steel City Testing Machines, Detroit 33, Mich.* 4-page bulletin describes Model B-1 Flex-Tester, an instrument for non-destructive testing of sheet metal for drawing qualities and stretcher strain. Features and specifications.

21 TAP HOLDERS & DRIVERS — *Scully-Jones & Co, Chicago 8, Ill.* 8-page bulletin 4-50 gives specification and application information on heavy-duty holders, close center tap drivers and chucks, and new line of JT compression and tension holders of lock-and-eject type.

22 GRINDING COOLANT — *Motch & Merryweather Machinery Co, Cleveland 17, Ohio.* Bulletin describes Triple C coolant, now available in liquid as well as crystalline form. Additional information on Triple C machine cleaner.

HEAT TREATING AND WELDING

23 GAS CUTTING MACHINE — *Air Reduction Sales Co, New York 17, NY.* 12-page catalog 304B presents illustrated information on Model 6B Oxygraph multiple torch unit and its accessories. Features described; dimensions and operating limits diagrammed.

24 FURNACES & HANDLING EQUIPMENT — *Salem-Brosius, Inc, Carnegie, Pa.* 32-page illustrated brochure "Equipment for Industry" gives descriptive and technical data on furnaces and accessories, special valves, mechanical equipment, materials handling systems, water purification processes.

25 SURFACE ALLOYING TECHNIQUE—*Chromalloy Corp, New York 33, NY.* 4-page illustrated bulletin, "Applications of Chromising," gives 19 typical applications of process for increasing heat, wear, and corrosion-resistance of ferrous metals by diffusing chromium into surface at high temps.

26 INDUCTION MELTING FURNACE —*Ajax Engineering Corp, Trenton 7, NJ.* 4-page folder describes characteristics and operation of combination melting and holding furnace and automatic pouring unit, the Duplex Ajaxomatic, for use in die-casting aluminum.

PLANT SERVICE EQUIPMENT

27 BARREL FINISHING COMPOUNDS — *Newton Industries Inc, West Haven, Conn.* Set of four 4-page illustrated brochures describes Class A compounds for heavy deburring and cutting; B for deburring and semi-burnishing; C for burnishing; D for cleaning. Guide tables for correct finishing of metals, plastics, castings, and parts specify correct amounts of compound and water, type of media, and finishing time required.

28 AUTOMATIC TRANSMISSION FOR FORK LIFT TRUCKS — *Towmotor Corp, Cleveland 10, Ohio.* Illustrated booklet describes TowmoTorque drive with Creep-Control feature that enables operator to inch the truck along smoothly while maintaining high engine speed for full lifting power.

29 HANDBOOK OF HYDRAULIC TABLES—*Aldrich Pump Co, Allentown, Pa.* New edition of bulletin 50, a 28-page reference work, contains tables and engineering data on pumping and piping.

PARTS AND MATERIALS

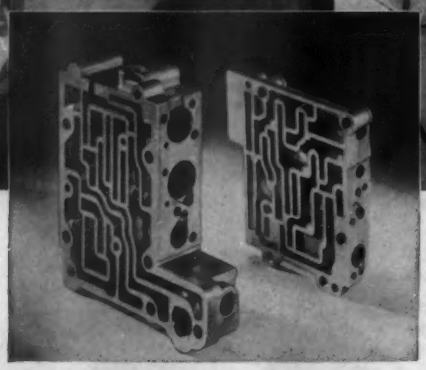
30 MOTORS AND DRIVES—*The Louis Allis Co, Milwaukee 7, Wis.* Illustrated bulletin 1750 covers special and standard motors and adjustable speed drives. Installation photos and technical data on electrical features included.

31 STAINLESS STEEL — *Allegheny Ludlum Steel Corp, Pittsburgh 22, Pa.* 10-page booklet contains technical data on AM 350, a chromium-nickel-molybdenum stainless, hardenable by subzero cooling or double aging. Includes tables on mechanical properties, stress rupture, elevated temp tensile properties, corrosion rates in various media.

32 HYDRAULIC AND AIR COMPONENTS—*Star Jack Co, River Grove, Ill.* 36-page catalog 555 gives illustrated description of pumps, cylinders, jacks, braces. Features, specifications, applications included.

33 ROLLER BEARINGS — *Orange Roller Bearing Co, Orange, NJ.* 40-page engineering reference manual gives construction, dimensions, capacities, housing and tolerance fits on staggered roller bearings, full-type and cage-type needle, journal roller, cam followers, cam yoke rollers, and thrust roller bearings.

● NICKEL SILVER AND PHOSPHOR BRONZE—*Waterbury Rolling Mills, Waterbury, Conn.* 60-page illustrated general catalog gives data on line of alloys in sheet, strip, and coil. Technical information, tolerance and reference tables, properties, specifications. Request direct on company letterhead.



Holes on extremely close centers vary in diameter from 1/16" to 13/16". The valve body has 33; the cover, 18.

"—BUT OUR PRODUCTION RUN IS LIMITED."

"SO WAS THE RUN ON THIS AUTOMATIC TRANSMISSION PART, BUT". . . .

HERE'S HOW ZAGAR TOOLING SAVED MONEY HAND OVER FIST

This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.

Ask on your letterhead for Bulletin "A-11"

ZAGAR TOOL, INC.

24000 LAKELAND BOULEVARD • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

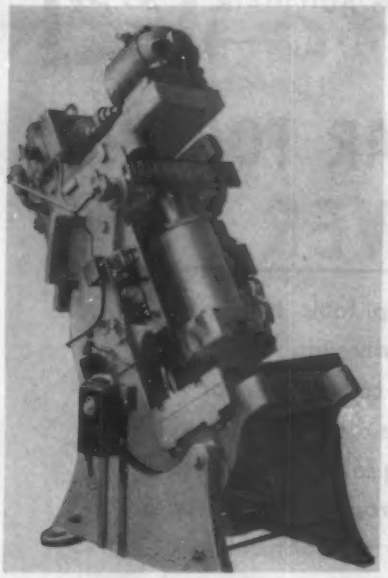
Rockford Openside Shaper-Planer Has 6- to 20-ft Stroke Lengths

Shaper-planer is built in 30 x 24-in., 30 x 30-in., 36 x 36-in. and 36 x 42-in. table sizes, with stroke lengths of 6 to 20 ft, in 2-ft increments. Machines are equipped with hydraulic triple circuit, said to give the correct combination of cutting speed and force for most economical machining. Three cutting ranges are provided, including high speed with low cutting force, medium speed with medium force, and low speed with heavy cutting force. Speeds are infinitely variable from 10 to 300 fpm, with maximum return speed regardless of cutting speed.

Tool heads have vertical feed engagement. Toolhead saddles and vertical feed slides are equipped with adjustable double nuts, and toolheads have inside clapper box and positive abutment to take thrust of cut.

Maximum cross feed and vertical feed are 0.500 in.

Rockford Machine Tool Co, Department A, 2400 Kishawaukee St, Rockford, Ill

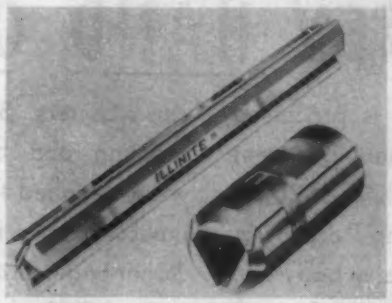


Die Tryout Press Has Hydraulic Action

Bliss press developed for die tryout and pilot production runs has hydraulic action and gap frame construction. Hydraulic action on the press reportedly allows precise control of inching, permitting close observation of die action. A longer-than-standard stroke compensates for die space and press setup adjustments.

All models are built to receive standard press accessories, and are available in capacities from 50 to 250 tons.

E W Bliss Co, Canton, Ohio



Three-Flute End Mills Held By Special Collet

Tri-Mil three-flute end mills are said to have longer life, with easier resharpening. The cutting edges of the tool form an equilateral triangle, with the edges running the entire length of the tool. Because there is no shank on the tool, special 3-side-bearing collets are used as holders, which makes it possible to hold the tool closer to the work than might be done with conventional tools. Also, as the end of the tool wears down, it can be ground off and new end teeth ground in.

Regrinding can be done on a surface grinder, several tools at a time. Tools are furnished with right-hand cut as standard, but by grinding teeth in the opposite end, a left-hand-cutting tool is created. Available in various standard sizes.

Illinois Tool Works, 2501 N Keeler Ave, Chicago, Ill

MicroSwitch Needs 2½-oz Actuating Force

Low-force, heavy-duty MicroSwitch requires 2½ oz of force, and is designed for use with counting devices and similar applications.

Actuating lever is 5-in. aluminum rod, ⅛ in. in diameter, which can be bent or cut off to suit the user's needs. Overtravel is 60°. Switch is aluminum-enclosed, and can be conduit-wired, without removing the enclosure from its mounting.

Available in either of 2 contact arrangements, SPDT, designated 1ML10, and 2-circuit break, designated 101ML10. Both are rated at 10 amps, 120v, 240v, and 480v.

MicroSwitch Div, Minneapolis-Honeywell Regulator Co, Freeport, Ill

Portable grinding - wheel - balancing unit uses adjustable weights which are set inside master weight-holders. Master units are locked in place, and internal weights are added as needed to balance. Unit includes wheel puller. Also available for centerless-grinding wheels.

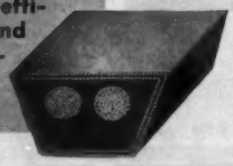
Crestline Products, Inc, 208 Paramount Bldg, Ft Wayne 2, Ind

TEXROPE
Greatest Name in V-Belt Drive

The Only Complete Line of Variable Speed V-Belt Drives

Texrope Fixed-Speed Drives

For transmitting power efficiently between motor and load where speed variation is not required.



Texrope Grommet Belts

This heavy-duty construction gives from 30% to 50% longer life at no extra cost. The grommet is endless, eliminating the stiff overlap that sets up strains and causes eventual breakdown in ordinary belts. Oil-resisting and static-conducting belts also are available.

Magic-Grip Sheaves

Designed for fast, easy mounting and dismounting. You simply slip the assembled unit on the shaft, slide it to the desired position and tighten the screws which clamp the split tapered bushing on the shaft. The result is safe, smooth-running performance.

Stationary Control *Vari-Pitch* Sheave

where speed changes are infrequent and machine can be stopped to make the change.

9% to 38% Speed Variation

One *Vari-Pitch* sheave and one fixed-diameter sheave are used to get this speed variation. Here's the low-cost way of providing variable speed. No need for high-cost special motors or electrical control. Takes only a few minutes to alter pitch diameter to change speeds.

To 196% Speed Variation

Two *Vari-Pitch* sheaves — one on the driver shaft and one on the driven shaft — can greatly increase the range of speed variation. *Vari-Pitch* sheaves provide long-lasting, dependable performance, plus accurate speed control.

Motion Control *Vari-Pitch* Sheave

for applications where frequent changes must be made while drive is in motion.

Single motion-control type for speed variations to 38%. Simply turning a handwheel provides positive speed change using motion-control *Vari-Pitch* sheaves. Handwheel actuates adjusting mechanism to change sheave pitch diameter and adjust belt tension by moving motor base.

Double motion-control type for speed variations to 196%. Motion-control *Vari-Pitch* sheaves can be used on both driven and driver shafts. In this case changes in pitch diameter of motor sheave are offset by an opposite change in the driven sheave — thus maintaining constant belt tension.

Texrope, Magic-Grip and *Vari-Pitch* are Allis-Chalmers trademarks.

For further information ask your Allis-Chalmers Distributor or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS

A-4845

Gleason Adds Automatic Unloader To No. 16 Quenching Press

Unloader attaches to left-hand front corner of press, and is controlled by built-in switches and valves. Device can be attached to existing No. 16 Gleason quenching presses.

Sequence is: As press carriage advances to unloading position, the unloader arm rotates into position over the quenched part. Then the unloader head lowers, and adjustable jaws close on the part. Holding the part, the unloader head rises and rotates through 180°. Jaws open, releasing the part into a tote basket or conveyor.

Press accommodates round, flat, or irregular parts up to 15 in. in longest dimension. Parts are held between dies during the quenching cycle, which is said to reduce distortion to a minimum.

Gleason Works, Rochester, NY

B&S Super Vernier Height Gages Have Extra-Long Vernier Plate

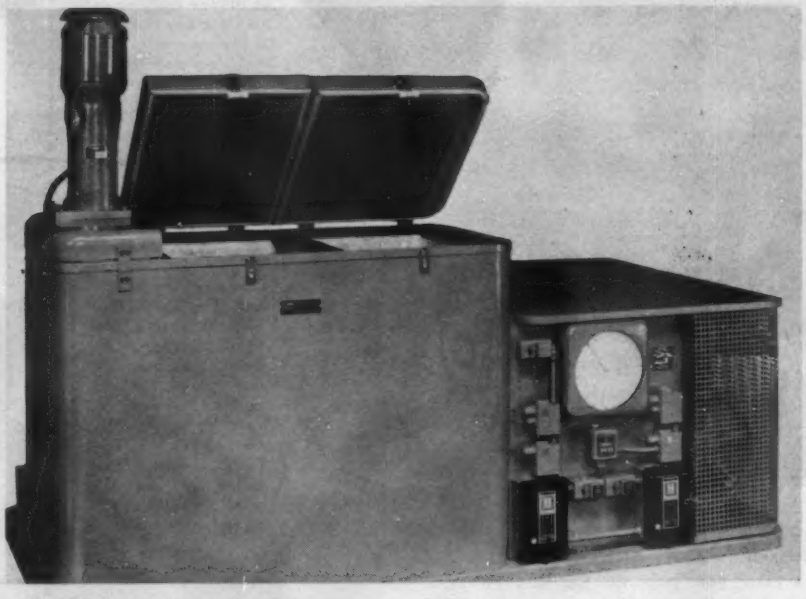
Super Vernier height gages have sunken dull chrome background on which machine-cut graduations and figures are black. Tools also have vernier plate said to be twice as long as conventional plates, to aid reading and setting.

Offset marker permits measurement from zero up. By loosening clamp screw, lower marker can be advanced or retracted, providing over or under measurements as desired.

Three sizes are available—12 in., 18 in., and 24 in. Two styles are offered—No. 586 English measure, and No. 588 English and metric measure.

Circular available.

Brown & Sharpe Manufacturing Co, Providence 1, RI



Chilling Unit Has Large Thermal Capacity

Model 3SR-120-16, designed especially for quenching procedures in the heat-treating of perishable tools, has rated thermal capacity for chilling 250 lb of tool steel from +80° F to –120° F per hour. Chilling chamber is 48 in. long, 18 in. wide, and 33 in. deep. Total capacity of galvanized steel chamber is 16 cu ft or 110 gallons.

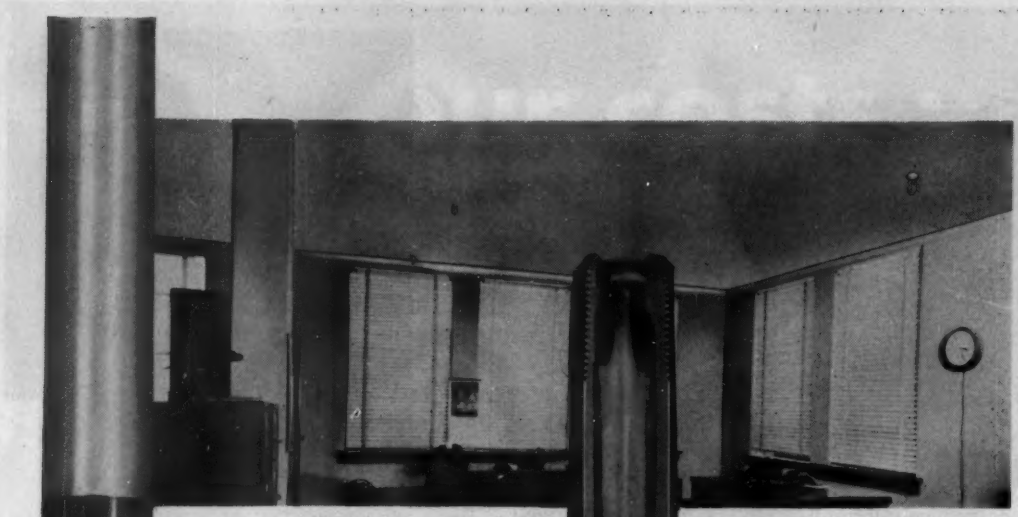
Machine is used in heat-treating of alloy steels where low-temperature quenching is required to achieve transformation of austenite to martensite. Small toolbits being treated are placed in chilling chamber in baskets; an agitator provides mechanical agitation of the convection fluid in the chamber for uniform cooling.

Machine may be used with or without convection fluid. If fluid is used, an air circulator is mounted on one of the lids to speed chilling.

Instrumentation and controls include a temperature controller with range from –70° to –150° F, a recording thermometer with range from 6° to –150° F, and a 12-in., 24-hr chart. Two 5-hp motors power the refrigeration system.

Construction is of heavy gage steel. Unit is 96 in. long, 50 in. wide, and 45 in. high.

Cincinnati Sub-Zero Products, 3930 Reading Road, Cincinnati 29, Ohio



Office with concealed piping, only the heads showing

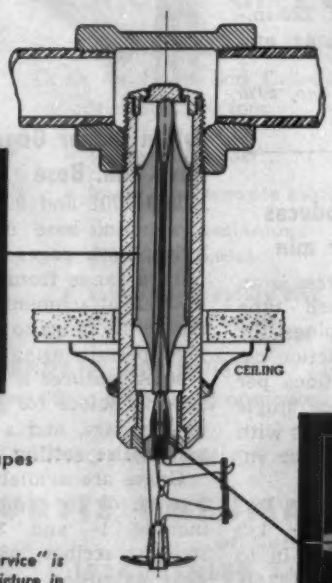
REVERE Extruded Shapes

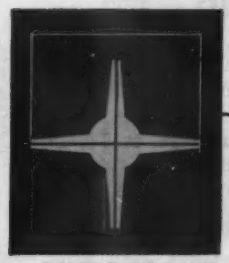
in dry pendent sprinkler heads lessen machining, save money

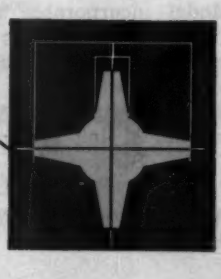
Some 16 years ago the Viking Corporation, Hastings, Michigan, decided to find a way to put sprinkler piping for dry pipe systems above the finished ceiling, leaving only the sprinkler heads visible. This meant designing a sprinkler head which would be free of water except when in use. Thus there would be no drainage problem, and no chance of freezing. The dry pendent sprinkler head as finally developed extends into the sprinkler pipe, where a bronze cap keeps the entire valve waterless. When a fire occurs the usual fusible element melts, two struts drop, releasing the cap and permitting water to flow.

In the original experimental work, the two struts were machined out of solid brass bar. This took time and involved the generation of a considerable amount of scrap, since each strut has four deep fins. Once the idea had proved itself, Viking came to Revere for extruded shapes, in order to save both machining and metal. So much time has elapsed since the original machining of the bar that comparative cost figures would be meaningless, but it is evident to Viking, and to everybody familiar with extruded shapes, that the saving is substantial.

Cross section of Viking Dry Pendent Sprinkler Head, and cutaway view







Outline of the two shapes supplied by Revere

"The Revere Four-Way Service" is a 16mm. sound motion picture in color, educational and informative. If you haven't seen it, write nearest Revere Sales Office.

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COPPER AND BRASS INCORPORATED

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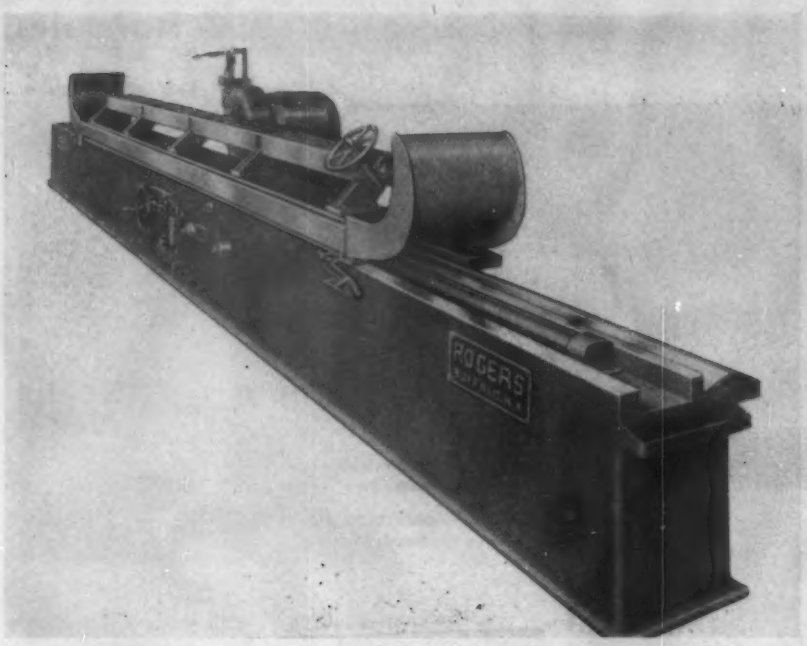
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.



Cabinet-Base Knife Grinder Has Hydraulic Table Drive

Series 220 Rogers cabinet-base knife and face grinder is of traveling table design, for face and bevel grinding of shear blades, chipper and other straight knives, and production face grinding of steel parts.

Machine has hydraulic table drive with speeds variable from 10 to 100 fpm. Faster speeds are available if desired. Hydraulic system includes cylinder, pump, valves, gages, piping, and 5-hp motor and controls.

Carriage travels on self-aligning combination ground ways of type with one V and one flat way. Grinding wheel head has built-in motor with special spindle mounted on preloaded ball bearings. Wheelhead motor is available in 25- and 15-hp capacities.

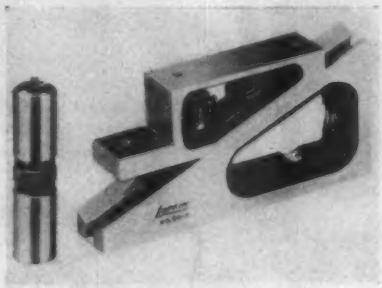
Segmental grinding head of 20-, 24-, or 30-in. diameter is mounted directly on motor spindle. Wheelhead is automatically or manually fed to work, and is adjustable for flat or bevel work. Magnetic chuck, mechanical knife bar, and swiveling worktable can be furnished.

Bed and table ways are separately lubricated by special automatic oiling system. Machine is equipped with motor-driven coolant system. All heavy castings are normalized.

Standard sizes range from 78 to 220 in., in 9 sizes. Larger sizes are available on special order. 220-in.-capacity machine is 30 ft long, and weighs more than 11 tons.

Samuel C Rogers & Co, Inc, 2070 Sheridan Dr, Buffalo 23, NY

TOOLPOST HOLDER is designed for jobs using grinder on a lathe. Made of 9/16-in. cadmium rolled steel, holder is for specific use with Mall pneumatic models PG-K-1030B and 1030L—*Mall Tool Co, 7725 S Chicago Ave, Chicago 19, Ill*



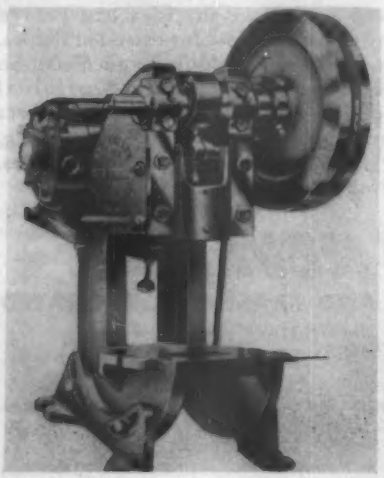
Lufkin Planer Gages Have 1-in. Base

Models 901 and 901A planer gages have 1-in. base designed for stability. Both gages are 5¼ in. long, with a range from ⅜ in. to 7¾ in. without attachments. Extensions increase the range to 10¾ in. A plumb level permits using the gages on end.

901A features a rapid adjustment locking device for quick positioning of the gage, and a fine adjustment for precise setting.

Gages are available with 3-in. extension or in complete sets which include 1- and 3-in. extensions, straight scriber, offset scriber and gage extension, and scriber-holding attachment.

Lufkin Rule Co, Saginaw, Mich



Two-Ton Punch Press Produces Up to 250 Operations per min

Allen Model BT-2 punch press is an open - back - inclinable, bench - type unit. Suited to small stampings, the machine has a mass production capacity of up to 250 operations per minute. Model incorporates single pin clutch, straight ram guides with flat gib, adjustable ram, frame inclinable to any angle.

Specifications: weight, 116 lbs; standard stroke, ¾ in.; motor, 1/3 hp; V-belt drive. Strokes of ¼ in. to 1½ in. are optional. Price is $127.50.

Alva Allen Industries, 1001 N 3rd St, Clinton, Mo

Cut your costs with *Curtis*

AIR COMPRESSORS
AIR HOISTS
AIR CYLINDERS

A plentiful supply

of air to speed production throughout your plant is assured with powerful, precision-built *Curtis* Air Compressors.

- **air-cooled, two stage—¼ to 20 H.P. inclusive**
- **water-cooled, single stage—20 to 50 H.P. inclusive**
- **Timken tapered main bearings permit easy external adjustment**
- **long-life pressure-lubricated connecting rod and piston pin bearings**

Tank-mounted compressors in sizes from ¼ through 15 H.P. inclusive (1 to 78 cu. ft.)—also available in base-mounted type.

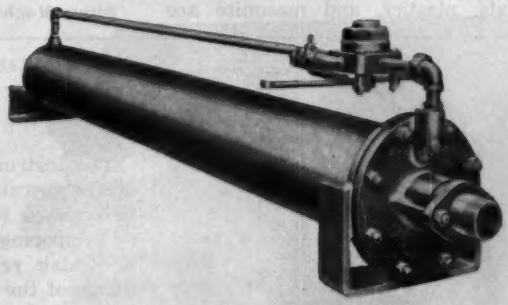
Simple and base-mounted compressors from ¼ through 50 H.P. inclusive (1 to 300 cu. ft.).

LIFT, LOWER, PUSH or PULL

easily, economically and safely with *Curtis* Air Hoists and Cylinders . . . capacities up to 10 tons.

- **lower initial cost**
- **lower maintenance costs**
- **smooth operation and precision control**
- **self-closing, rotary disc self-grinding valves**

PENDANT AIR HOISTS . . . ideal for any lifting or lowering operation.



BRACKETED AIR CYLINDERS . . . can be mounted horizontally or vertically for lifting, lowering, pushing or pulling.

FOR COMPLETE INFORMATION ON THIS CURTIS COST-SAVING EQUIPMENT . . . WRITE TODAY!

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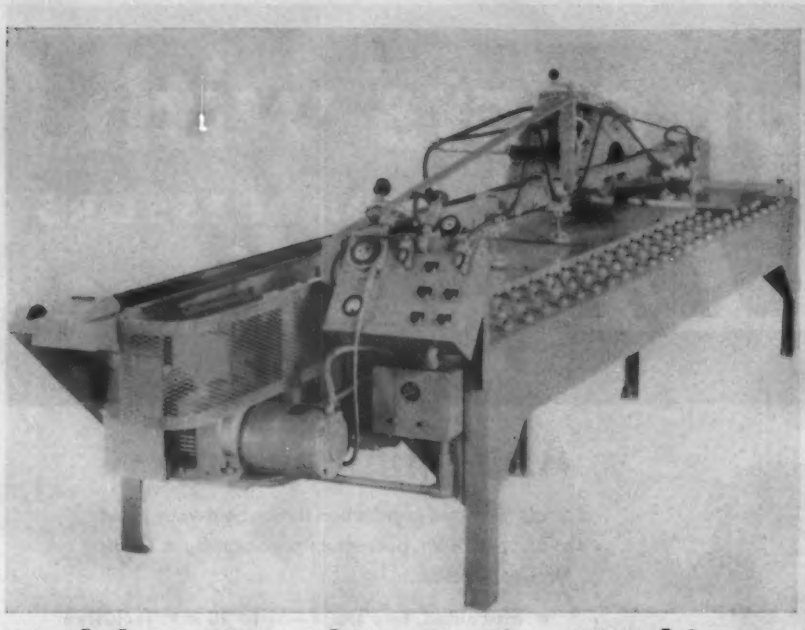
CM-837

OTHER CURTIS PRODUCTS: Automotive Lifts and High Pressure Car Washers; Commercial and Home Air Conditioning



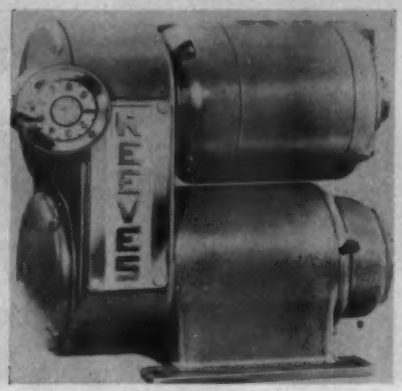
Model SS-20LR Plate-Cutting Machine Uses Abrasive Wheel or Saw

Model SS-20LR is a traverse-type cutting machine for ferrous and non-ferrous plate and steel stock. Machine has a new locking roller assembly that locks it to a special channel rail, which is said to permit better rigidity and control over the job. In climb cutting, all chips, dust, and sparks are disposed through the kerf in the table keeping guide lines clear.

Ferrous metals are cut with an abrasive wheel, while non-ferrous metals, plastics, and masonite are cut with a circular steel saw blade. When cutting non-ferrous metals, an oil-mist coolant is directed at the point of contact between blade and material.

According to the manufacturer, tolerances on all cutting are within 0.010 in., and cutting can be done at these rates: ¼-in. stainless steel plate at 8 sec per ft; 1-in. aluminum plate, 5.4 sec per ft; 1-in. melamine stock, 100 sq in. per min; 1½-in. laminated plastic at 10 sec per ft.

Stone Machinery Co, Manlius, NY



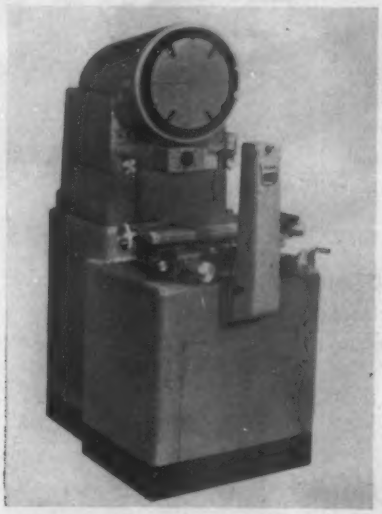
Reeves No. 100 Series Drives For Small-Area, 1-hp Application

No. 100 series Vari-Speed Motodrive is said to provide 20% space saving over space needed for previous models. For 1-hp applications, the drive unit occupies space of 16 5/16 x 21½ x 11½ in. in vertical model.

Contains 1-hp "weatherized" motor, speed changing mechanism, and gear reducer, where required. Available in speed ranges from 2:1 to 8:1, in any of 112 different assemblies. Threaded spiral groove lubrication is said to assure complete coverage of lubricant on all sliding surface. Overflow carries any excess lubricant away from disk faces and V-belt. All-position handwheel control is standard, but mechanical automatic and electric remote controls are available.

Bulletin M-543.

Reeves Pulley Co, Columbus, Ind



Kodak Contour Projector Handles Large Parts

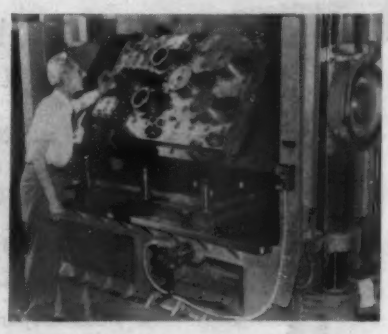
Model 14-5 contour projector combines 8-in. table travel and a 14-in. screen. Work is carried on a heavy-duty worktable supported on a 5-in.-OD column. 26 x 8-in. worktable travels both horizontally and vertically.

The instrument is designed to directly measure parts to 0.0001 in. or to be used for gaging routed work by comparing the image with a chart. A Kodak relay lens picks up the image of the part and directs it into the projector lens at the rear of the cabinet. A lens turret permits choice of six magnifications at the turn of a knob. 10 x12-in. or 11 x14-in. overlay chart gages will fit the machine.

Special Products Sales Div, Eastman Kodak Co, Rochester 4, NY

Protective coating, Dimetcote, reportedly gives steel the same protection that galvanizing affords, plus salt water resistance. Coating is an inorganic, metallic zinc substance that contains no oils or resins. Material costs less than 6¢ per sq ft.

Amercoat Corp, 4809 Firestone Blvd, South Gate, Calif



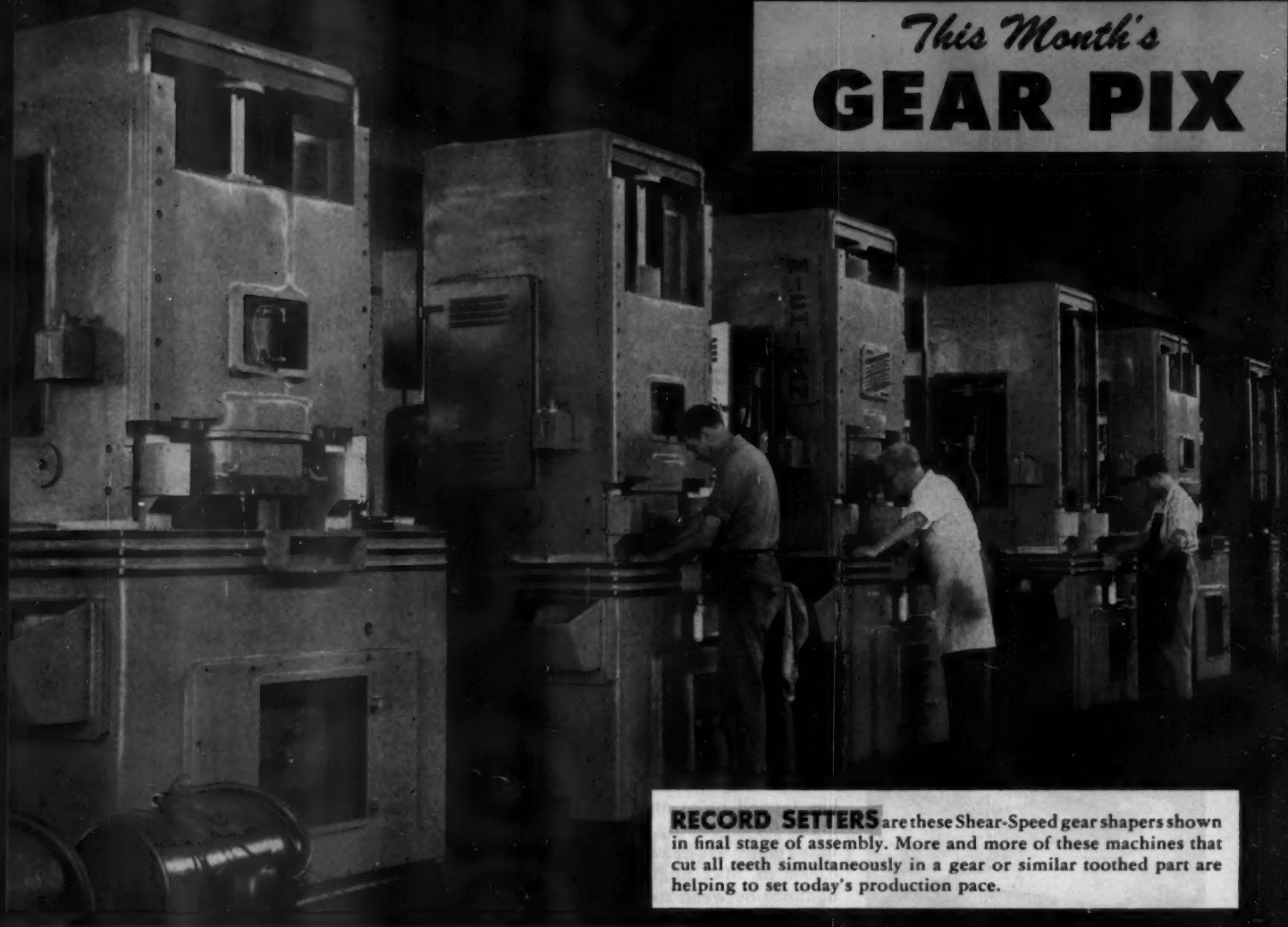
Hansford Die Handler Takes 6000-lb Die

Hansford Model 1014 die-handling machine, largest made by the company, can handle dies or molds measuring 36 x 75 in. and weighing up to 6000 lb. The top platen of cast Meehanite is raised and lowered with leadscrews driven by a 2-hp motor mounted in the base. Rate of rise is 12 in. per minute. Platen can be rotated with power supplied by a ¾-hp motor.

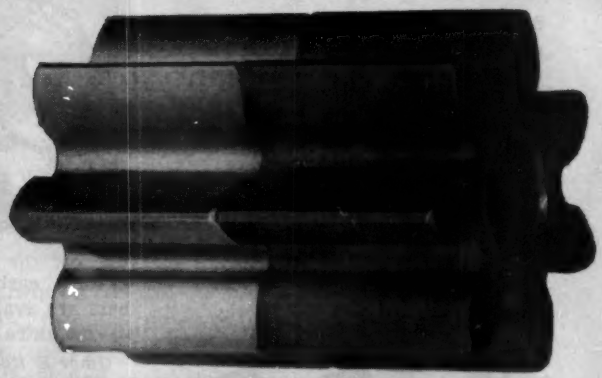
Hansford Manufacturing Corp, 1239 University Ave, Rochester 7, NY

This Month's

GEAR PIX



RECORD SETTERS are these Shear-Speed gear shapers shown in final stage of assembly. More and more of these machines that cut all teeth simultaneously in a gear or similar toothed part are helping to set today's production pace.

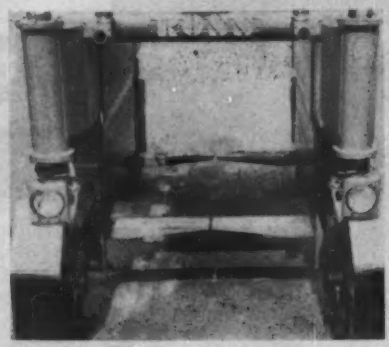


CAST BLANK ON BOTTOM, steel blank on top, eliminates burrs when all teeth on both gears are cut simultaneously on Shear-Speed gear shapers. These mating automotive oil pump gears operate more smoothly due to close tolerances, smooth surface finishes, and perfectly formed 0.080-inch radii at the tooth fillets with no scallops or ridges. Three Shear-Speed gear shapers produce these gears for one of the best known automobiles.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

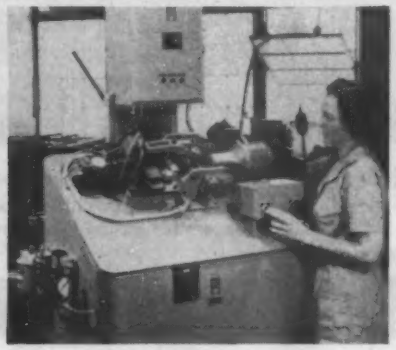


Ross Carrier Has Pivoted Load Hooks

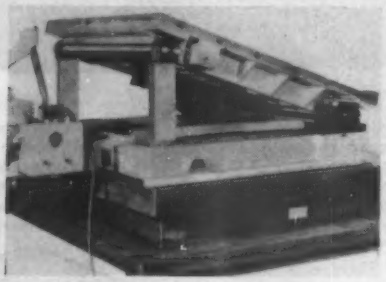
Series 81 pivoted-hook carrier has a capacity of 20,000 lb, road speeds up to 40 mph, four-wheel steering, and four-speed synchromesh transmission. Carrier is available in six models capable of carrying loads ranging in height from 48 to 66 in. and in width from 40 to 52 in.

In place of conventional load hooks, models have four forks, two on each side, which swing in at right angles and meet in the center to form two arms under the load. Hydraulic cylinders actuated from driver's seat control horizontal pivoting and vertical movement. Hooks extend under full width of load, eliminating bolsters.

Ross Carrier Div, Clark Equipment Co, Benton Harbor, Mich



BALL STUDS on V-8 engine valve rocker-arms are 100% gaged for OD size and presence of an oil hole by Federal gage that is an integral part of the production line. The power unit which checks the part actuates relays which control the disposal chute, sorting the parts as either good or scrap at the rate of 3600 to 5000 per hr—*Federal Products Corp, 1144 Eddy St, Providence 1, RI*

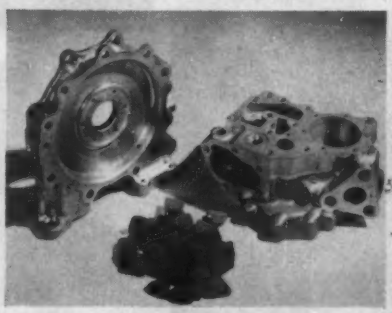


48 x 48-in. Sine Plate

This 48 x 48-in. sine plate, added to Robbins' standard line, has 2304 sq in. of working area.

Mechanical raising and lowering of the top plate is electrically controlled. Power is supplied by a 1-hp motor. Hand control wheel permits fine adjustments of the top plate on the gage blocks or standards.

Single-angle, non-magnetic tool has tapped holes and T-slots in top plate for clamping. Top plate and base plate are scraped parallel to 0.0008 in. Max angle setting is 60°; distance between roll centers, 40 in.; unit weighs 4000 lb. Hardened and



ground carburized steel clamping bars are available for positive rigidity on extra heavy duty work.

Omer E Robbins Co, 24800 Plymouth Rd, Detroit 39, Mich

Norton Barrel-Finishing Media

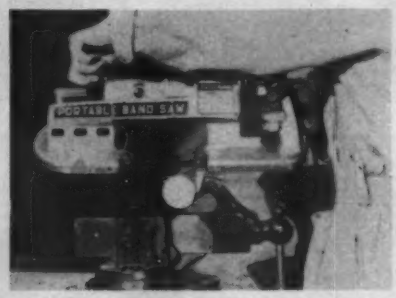
Tumblex T is Alundum-vitrified bond, triangular-shaped barrel-finishing abrasive. The medium was developed to overcome the tendency of abrasives to wedge or break when finishing certain shapes of parts, especially those with holes, slots, and recesses.

Compound is said to be chemically inert, and is available in 4 sizes, 4, 3, 2, and 1 (⅜ in., ⅝ in., ⅞ in., and 1⅛ in., when measured on the side of the triangle) and ranging in width from 3/16 in. to 5/16 in. Weight is 85 lb per sq ft.

Tumblex N is a natural material which is designed for finishing such parts as die castings, where conventional abrasives might cut through the outside protective layer and expose the porous structure beneath. Tumblex N is often used with small amounts of loose abrasive when added cutting power is needed. The loose abrasive can be flushed out of the barrel and the basic medium used for finishing.

Compound is available in 7 sizes, from 3/16-to-⅜ in., to 1⅝-to-2½ in.

Norton Co, Worcester 6, Mass

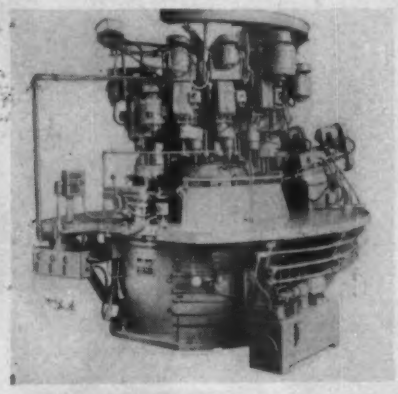


HSS Bandsaw Blade for Problem Materials

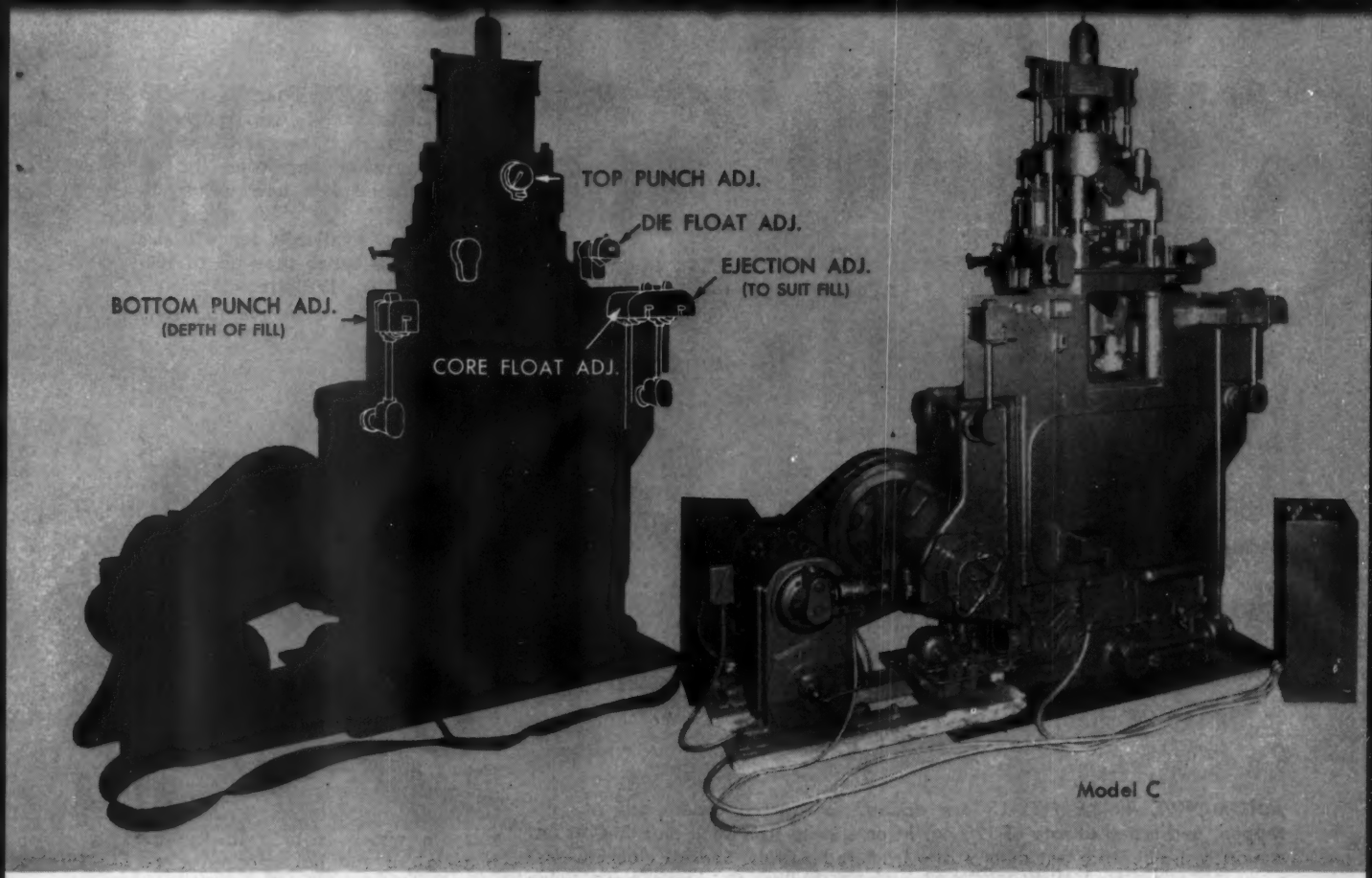
HSS blade for portable electric bandsaw is designed for use with Model 524 Porta-Band saw, when cutting such materials as stainless steel, carbon tool steel, nickel, and HSS.

Blade is available in 6, 9, 12, and 16 teeth-per-in. sizes, 0.020 in. thick. Catalog available.

Porter-Cable Machine Co, 59 Exchange St, Syracuse 8, NY



MORRIS MODEL 309-S machines 375 carburetor air horns per hour. Unit drills, burrs, reams, taps, and spotfaces, performing 24 operations on 21 holes on 4 perpendicular and 1 angular face. Drill units are mounted above table, on column, and on horizontal platen—*Morris Machine Tool Co, Harriet St, Cincinnati 3, Ohio*



INDIVIDUALIZED COMPONENTS of new Baldwin powdered metal presses make adjustments easy

It's mighty easy to make adjustments in density or weight in Baldwin's new Model "L" and "C" presses. That's just one of the results of a new concept of compacting powdered metals.

These revolutionary new Baldwin presses are not just remodeled heavy-duty pill presses. They have been designed expressly to meet your end product's needs. For example, instead of having combinations of actions, press components have been individualized. That enables you to make adjustments easily to fit any job.

Since there are no cams to change, many of the adjustments can be made while the presses are in operation. Also all controls are concentrated on one panel for easy supervision and adjustment. Two separate controls adjust the depth of fill and the stroke of the bottom punch. The relative position of the core rod to the die is also adjustable to aid in controlling the fill when making counterbored parts.

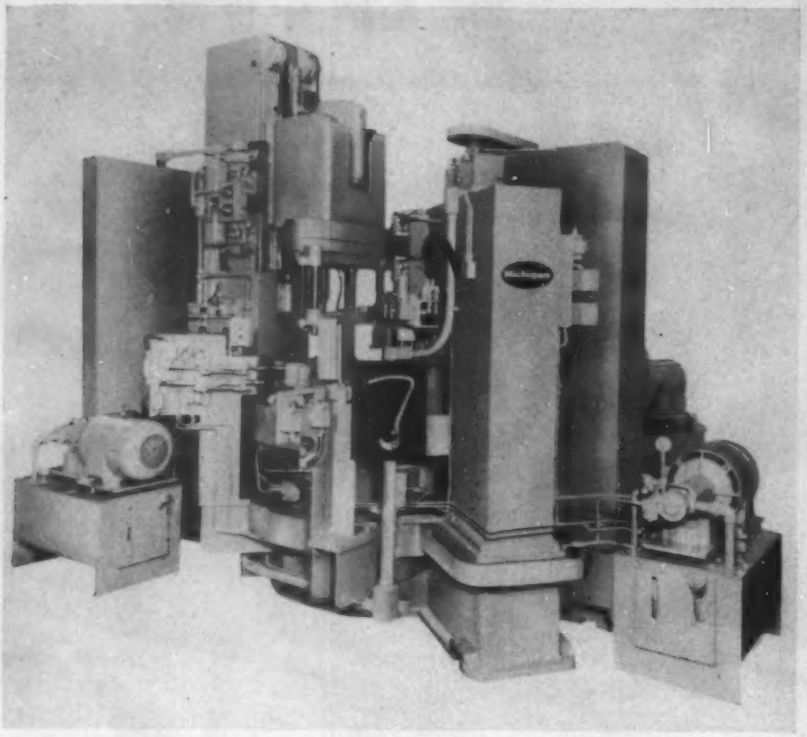
Further evidence of Baldwin's new concept includes such unique powder metal press features as . . . hydraulic heads, shuttle type feeders, independently floating die and core rod, automatic lubrication and variable cycling. It's no wonder that initial tests prove that these new Baldwin presses can out-produce competitive models by 200%, turn out compacts to closer tolerances and eliminate costly grinding operations.

You'll find more information and specifications on these new presses in our Bulletins 3101 (C) and 3104 (L). Write Dept. 4802, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

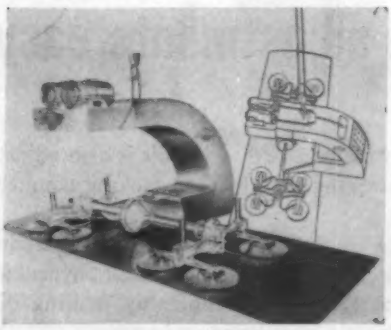
BALDWIN BLH LIMA-HAMILTON

Eddystone Division

BALDWIN-LIMA-HAMILTON



AUTOMOTIVE BRAKE PEDALS are drilled, spot-faced, chamfered, reamed, tapped, and tested at rate of 120 per hr on special six-station machine. At last station hydraulic ram test detects any fractured pedals. Special machine contains many standard Michigan components, including 42-in. automatic index table, Hydro No. 20 drillpress column, and Master leadscrew tapper—*Michigan Drill Head Co, PO Box 4643, Detroit 34, Mich*



Roll-Over Vacuum Sheet Lifter Has 1-ton Rated Lift Capacity

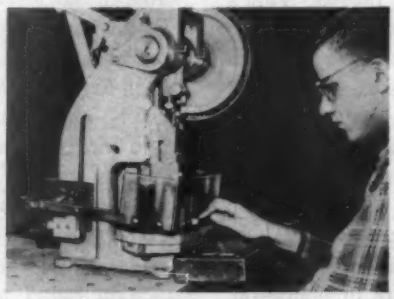
This 8-cup vacuum sheet lifter has a high limit capacity of about 14,000 lb, and is said to handle sheets of non-porous material up to 5 ft wide and 20 ft long weighing 2000 lb, with 7:1 safety factor.

Lifter is equipped with U-hook for attachment to overhead crane. Lift is accomplished by vacuum produced by 2 pumps. Vacuum is conveyed by tubes through storage tank to the rubber lifting cups.

Device is said to be able to rotate sheets 180°, and then carry the inverted sheet without dependence on vacuum. Rotating may be stopped at any angle from 0° to 180°, for inspection of both sides of the sheet.

Larger lifters are available for handling sheets to 4000 lb.

F J Littell Machine Co, Air-Vacuum Div, 4555 N Ravenswood Ave, Chicago 40, Ill



Searjeant Punch Dress Guard Protects End-Areas of Dies

Drop-gate electro-solenoid guard has been added to the Searjeant line of punch press safety equipment. The barrier is so designed that it surrounds the die area when in the down position, eliminating danger to the operator's hands.

Incorporated in the guard is a positive electric control of the press: the downward action of the gate causes a switch to energize a solenoid that is used to trip the press. Upward action of the guard resets a relay so that the press can be re-tripped on the next downward motion.

Units are available for all size presses from bench-type up to 100-ton and over. Bulletin 455.

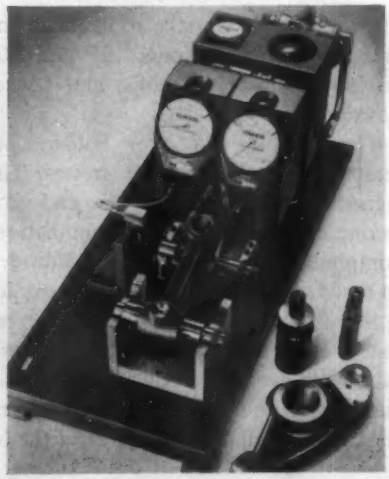
Searjeant Metal Products, Inc, Mendon, NY

Two-Piece Punch Has Removable Die

Unipunch is a two-piece perforating punch in which the punch head slides off the body, so that only the body need be replaced. A small button die which is held in the die pedestal of the holder can be replaced without removing the holder from the setup.

Series "A" units have a maximum capacity of ¼ in. mild steel and are available in stock holder widths from 1 in. to 2½ in., giving a perforating range from 0.093 in. to 1.500 in.

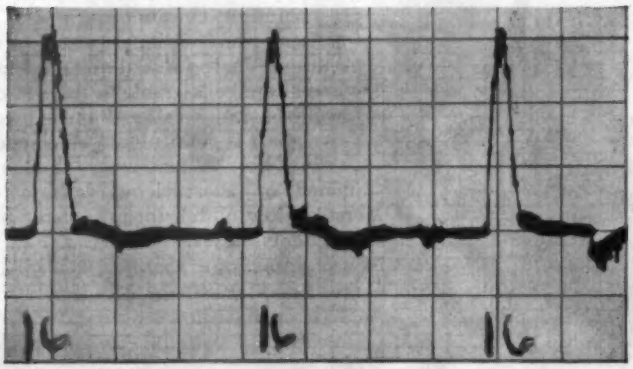
Punch Products Corp, 3800 Highland Ave, Niagara Falls, NY



DUAL DIMENSIONAIR GAGE checks parallelism of two bores in two planes on rocker arms. Gage is equipped with two sets of reference V's to accommodate two sizes of workpieces. Instrument checks two planes simultaneously — *Federal Products Corp, 1144 Eddy St, Providence 1, RI*

HY-PRO SPECIALIZES TAP TESTING

ACCURACY in Hy-Pro taps is measured in this Lead Check machine up to .00001 in., to guarantee precision operation for you.



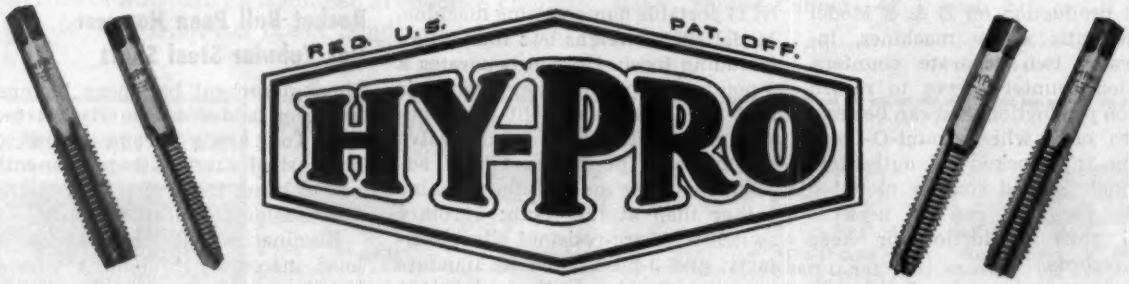
EVERY TAP IS PRODUCTION-TESTED AT HY-PRO—as indicated on their exclusive Torque Test Chart, which registers cutting power up to 2000 inch lbs.

...to cut your customers' tapping costs.

Hy-Pro specializes in producing taps. Every step in the production, from design to shipment, receives the full attention of Hy-Pro specialists.

Each tap is made under the severe standards of Hy-Pro, and is individually tested and checked before it is sent to your customers' production line. It is this consistent quality which has helped Hy-Pro win the reputation of *"The Tap Specialists"*

This specialized production can help cut your customers' costs. Remind them about Hy-Pro's specialized service. They will benefit from a full line of high-quality taps, backed by the experience of specialized engineering.



HY-PRO TOOL CO., NEW BEDFORD, MASS., U. S. A.

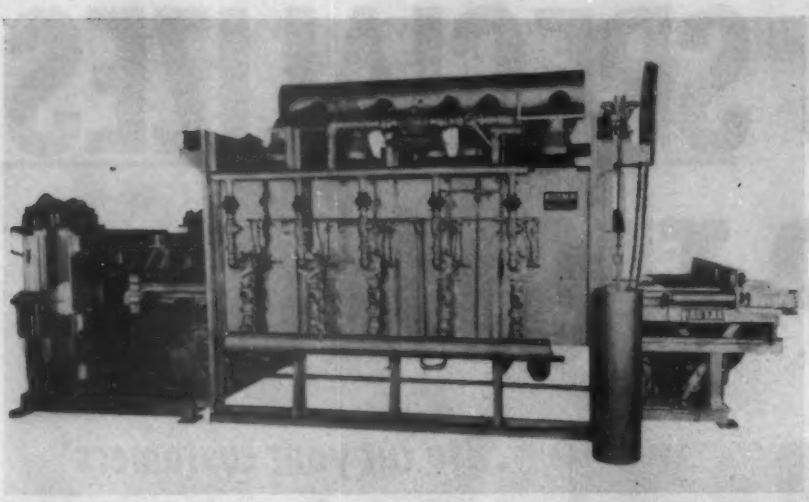
DISTRIBUTORS IN ALL LEADING CITIES

ADDITIONAL WAREHOUSES:

10428 W. McNichols Rd.
DETROIT 21, MICH.
University 4-1077

11232 Lawler St. (Worth)
CHICAGO, ILL.
Garden 4-0217

109 Edison Pl.
NEWARK 5, N. J.
Market 2-4318



AUTOMATED FORCE FURNACE, maintained at 2400 F by ten burners, receives blanks automatically from elevator stack. Crankshafts powered by gear reducers actuate walking beam mechanism which picks up blank and carries it step by step through furnace. Mechanism moves at varying velocities, lifting or depositing blank slowly and moving it to next position quickly. Rails carrying mechanism have central, water-cooled separator which is said to eliminate beam sag under heavy loads. On output end of furnace, unloader which derives motion from walking beam moves blank 40 in. to press — *Hautau Engineering Co, 721 Wanda, Ferndale, Mich*

Hamilton Clutch-Brake Unit Has Shoe-Type Design

Pneumatic friction clutch and brake unit for presses has four shoes, each with friction material bonded on outer periphery for clutch friction and on inner surface for brake friction. Shoes move radially and are each connected directly to an air-actuated piston.

In operation, air controlled by solenoid valve enters four diaphragm-type cylinders which are integral with clutch spider, forcing shoes out against clutch rings and engaging clutch. When air is exhausted from cylinders, two brake compression springs on each piston force shoes inward against brake rings and engage brake.

Clutch and brake are mechanically interlocked so that there can be no overlapping of their functions. Both cannot be engaged at same time. No adjustment of clutch or brake is necessary; shoes can be removed in few minutes.

Low inertia design of unit reportedly causes very little heat to be generated. Friction surfaces are close to outer periphery to allow for easy heat dissipation. Unit is said to allow for clutching and de-clutching press at speeds almost equal to speed of press running continuously.

Pressure on friction surfaces is at minimum during initial engagement, when slippage is greatest; full clutch torque is not developed until press drive shaft is rotating at same speed as flywheel. When press is being inched or is stuck at bottom of stroke, low clutch torque makes adjustments easier.

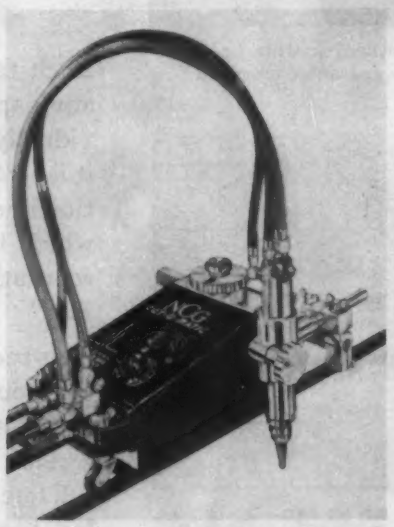
Hamilton Div, Baldwin-Lima-Hamilton, Hamilton, Ohio

Twin Counter for Screw Machines

Count-O-Larm unit, developed to record production on B & S Model 00 automatic screw machines, incorporates two separate counters. A sealed counter serves to record total job production, and can be reset to zero only when Count-O-Larm housing is unlocked by authorized personnel. Second counter mounted outside the case can be used to record shift production or keep daily records.

Model records only full-length parts. When bar stock is exhausted, red signal light on unit is lighted and warning buzzer is sounded.

Count-O-Larm Co, 1271 W North Ave, Chicago 22, Ill

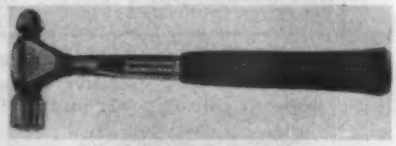


Flame-Cutter Weighs Less Than 30 pounds

NCG portable flame-cutting machine, Model No. 7, weighs less than 30 lb, including torch. Unit incorporates a 3-point suspension system which is said to minimize side-tilt and wobble. Other features include valve block which permits pre-heat adjustments to be made at the machine rather than at the torch; a rotary switch with arc-resistant silver contacts; and 3-hose torch as standard or with swivel head adjustable to 90°.

Machine may be had with either 110-115 v AC-DC or 220 v AC motor, standard or slow speed.

National Cylinder Gas Co, 840 N Michigan Ave, Chicago 11, Ill



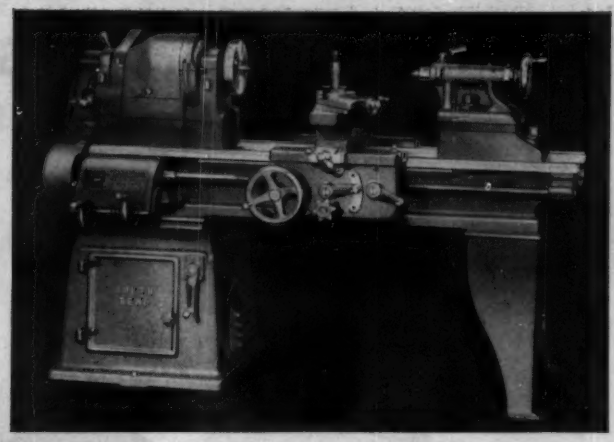
Rocket Ball Peen Hammer Has Tubular Steel Shaft

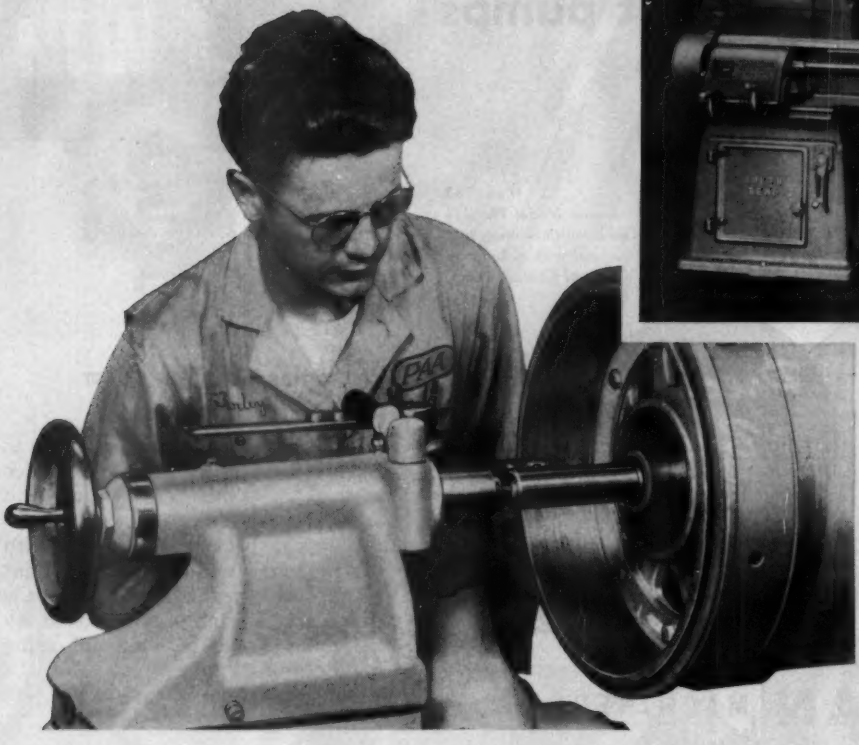
Shock-absorbent ball peen hammer has been added to the Rocket tool line. Tool has a chrome-plated tubular steel shaft with permanently locked head. Hand grip is neoprene-fiber cushion, bonded to shaft.

Elimination of large hump on head, necessary to hold a wooden handle, makes hammer convenient for use in tight places. Three models are available: 1, 1½, and 2-lb head weights.

True Temper Corp, 1623 Euclid Ave, Cleveland 15, Ohio

16-24" x 6' Quick Change Gear Lathe.





SOUTH BEND 16-24" LATHE

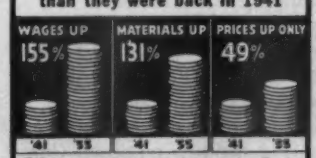
CAPACITY for Big Jobs! ACCURACY for Any Job!

Here's a lathe with a versatility that makes equipment dollars go further. Its 24" swing provides the capacity for handling a variety of large diameter, medium-weight jobs whose size would otherwise require large, heavy lathes. This extra capacity is achieved without any sacrifice of efficiency in the machining of smaller work.

Having an unusually wide range of spindle speeds, all sizes of work can be machined at effective cutting speeds. The improved South Bend two lever gear box permits instantaneous selection of power feeds for any turning, facing, or thread cutting operation. A complete line of chucks, tools and attachments simplifies tooling the lathe.

SPECIFICATIONS: Swing over bed and saddle wings—24⅜". **Collet Capacity**—1". **Spindle Speeds,** sixteen—11 to 710 r.p.m. **Longitudinal Feeds**—48 R.H. or L.H., .0015" to .0841". **Cross Feeds**—48 in or out, .0006" to .0312". **Thread Cutting**—48 Threads R.H. or L.H., 4 to 224 per inch.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941



Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

Ruthman GUSHER coolant pumps

Illustrated
Stanat Model TA - 624
Combination Rolling Mill
equipped with a Ruthman
Gusher Coolant Pump.

Each Gusher Coolant Pump is precision built — a credit to the metal working machines in which they are installed. The dynamically balanced rotating assembly cuts vibration and wear to a minimum. Pre-lubricated ball-bearings require no further attention. There is no priming or packing necessary. Your Gusher Coolant Pump is a highly efficient precision machine.

Precision Built FOR EFFICIENT OPERATION

Model 11022

THE RUTHMAN MACHINERY CO.

1818 Reading Road Cincinnati, Ohio

"HERE'S WHAT I LIKE ABOUT SHELDON LATHES

"First of all, I like their looks—their good lines, completely enclosed headstocks and substantial "tool room" appearance. I like the fact they have standard controls in the right places and big lathe "feel" and response. I like the extreme accuracy of their Zero Precision Tapered Roller Spindle Bearings — each bearing with a run out limited to 150 millionths of an inch; the front bearing (of the 13" Sheldon) rated 3540 lbs. for radial loads and 2335 lbs. for thrust loads, with maintenance limited to a rare ¼ turn of the bearing take-up collar, after long usage."

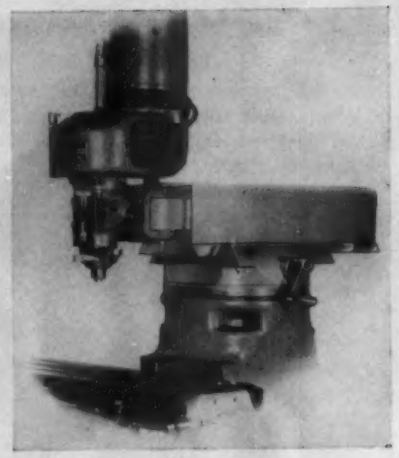
"Sheldon's extra collet capacity, means a lot to me, too. I like the wide beds, the heavy cross-girths and large ground and scraped V-ways and flat-ways. I like the quick change gear box with its 54 finger-tip pitches and feeds, the wide carriage and heavy full-box apron."

"If you want to know something else that really registers with me, it's the Sheldon drives —underneath motor drives fully enclosed in the headstock pedestal, with, or without outside speed change levers. I like the 16 drive speeds (8 speeds forward, 8 speeds reverse), and the not one plain belt, but two cogged neoprene V-belts to the spindle—no bouncing or slipping with these drives."

"What do I like about Sheldon Lathes?—everything . . . the lathes themselves and the wide choice of bed lengths with hardened ways: the entire set up of Taper attachments, Air Chucks, Bed Turrets, Collet attachments and 50 other accessories, that assure me of exactly what I want in my lathe. I like Sheldon's easy operation because it means I can put anyone in my shop on a Sheldon. I like the 19 individually checked points of accuracy, that assure me that a Sheldon not only can 'take it' but can *deliver* too. And another thing I never forget about Sheldon, is its price—because that means here's a lathe that can often pay for itself on its first job."

If you would like a Catalog with illustrations and specifications of all Sheldon Lathes, write SHELDON MACHINE CO., 4270 No. Knox Ave., Chicago 41, Ill. Data on Sheldon-built Sebastian Geared-Head Lathes will also be sent if requested.

(Advertisement)

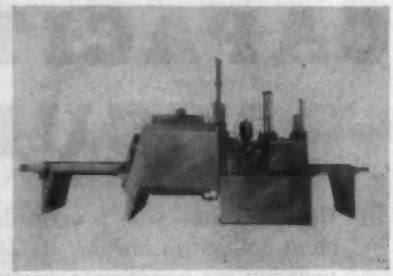


Production Ram For Miller Adds to Machine Capacity

Ram is designed to be added to Bridgeport milling machine. Device is said to permit heavier cuts, and to make positioning easier.

Ram can be rotated parallel with table to position spindle in that plane. Circle graduated in degrees is provided. Assembly is removed by loosening 2 clamp bolts and using hand crank.

Production Tool & Die Co, Inc, 572 St James Ave, Springfield, Mass



Ipsen Furnace Heat-Treats 1000 lb Per Hour

Model T-700-A is one of Series A line which has been redesigned to provide 50% greater loading, heating, and quench capacity. New features include ceramic tubes and redesigned elements and burners for generating higher temperatures; fan design that eliminates welded blades for producing stepped-up air circulation; and heavier transfer chains that handle greater loads.

New quench tank arrangement increases circulation of high and low oil as much as 300%, according to manufacturer. Tank is 50% larger in capacity and located for safety as far from heating zone as possible. Completely insulated, tank has instrument which guards against overtemperatures of quench oil.

Model takes maximum weight of

A NEW KIND OF END MILL JOINS THE BROAD ILLINITE® LINE

TRI-MIL* END MILL

a versatile end mill with a complete range of flute lengths... in a single tool!

Here's a new end mill with cutting edges running its entire length . . . having a productive life as long as its length! The advanced adapter design permits gripping at *any* position on the mill and can be located closer to work surface for greatest rigidity.

Tri-Mil is a combination of four conventional end mills: stub length, regular length, long and extra long. It's the perfect cutting tool for every slotting operation.

Ask your Illinite distributor for this Tri-Mil brochure.

Tri-Mil and all famous Illinite End Mills are available in a full range of types and sizes from your local ILLINITE END MILL DISTRIBUTOR. Call him today!

ILLINITE OFFERS THE MOST COMPLETE LINE OF END MILLS

ILLINOIS TOOL WORKS

2501 N. Keeler Avenue
Chicago 39, Illinois

*TRADE MARK

Phffft...and it's painted!

DeVilbiss automatic spray machine ups painting production. Example: finishing 3¼" O.D. flower pots up to 3600 an hour.

Just load your product or part on a high-speed DeVilbiss spray machine, and *phffft* . . . it's painted – automatically! And with the highest degree of uniformity! Split-second timing, accurate gun positioning, and synchronized conveyor speeds prevent streaks, sags, and wasteful overspray. You actually *save* materials, as you produce consistently better finishes in a fraction of the time consumed by manual methods.

Know in advance the savings of automatic painting

DeVilbiss offers automatic spray machines for painting products of practically any size or shape, and for use with most conveyor systems. To have us run a test on your product and report savings *before you invest a cent* – send us full data about your product, coating applied, number of coats, and production rate desired.

THE DEVILBISS COMPANY, Dept. 331, Toledo 1, Ohio

Santa Clara, Calif. • Barrie, Ontario • London, England

Branch Offices in Principal Cities

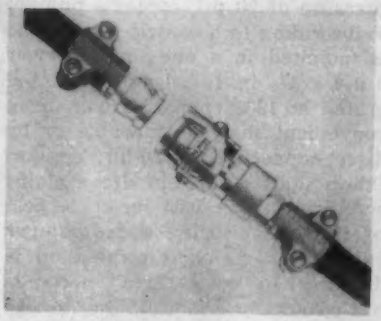
FOR BETTER SERVICE, BUY

DEVILBISS

With spindles six inches apart, chain-on-edge conveyor moves unpainted pot in position.
At precise instant, two guns spray with overlapping patterns as pot revolves three times.
Painting takes one half second. If spindle is empty, machine skips it; guns don't spray.
Finished pot moves as next one automatically takes position. Total cycle lasts one second.

1200 lb per charge, will handle 1000 lb per hr at maximum operating temperature of 1850°F. Hearth is 30 in. wide, 48 in. long, and 20 in. high; overall dimensions are approximately 6 x 30 x 12 ft.

Ipsen Industries, Inc, Rockford, Ill



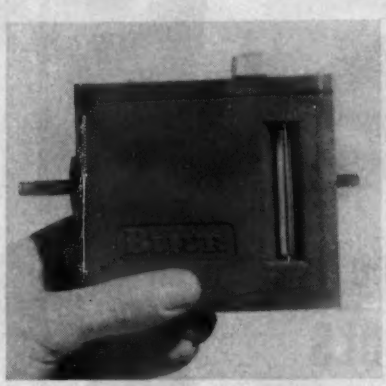
Valve Couplings Give Operator Complete Control of Air Line

Quick-As-Wink couplings are designed to permit line air to be shut off and tools changed easily, quickly, and safely at any point.

After connecting valve jaws half around the shoulder on connection half, operator advances knurled brass sleeve to "On" position, permitting line air to flow through sleeve and out through line to tool. Turning sleeve to right locks both coupling and valve in on position. Returning sleeve to "Off and Exhaust" position exhausts air in the tool to the atmosphere, trapping line air in sleeve, and permitting coupling jaws to be opened so that connection can be made to another tool. Turning sleeve to left locks valve in off and exhaust position, preventing valve from being opened accidentally to exhaust air under pressure to atmosphere.

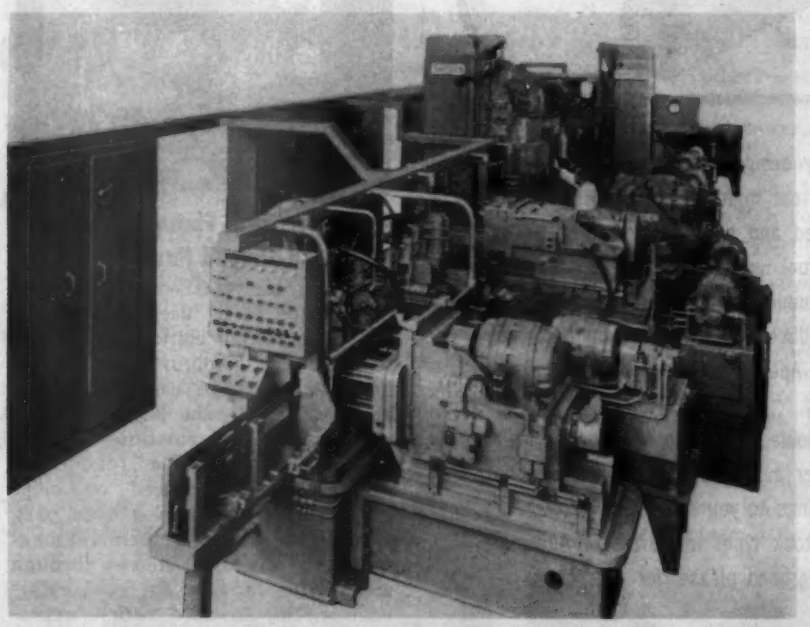
Units are available in ¼, ⅜, ½, and ¾-in. sizes for line air up to 250 psi. Any size valve half can be connected to any size connection half. Details in bulletin 551.

C B Hunt & Son, Inc, Salem, Ohio



Bijur Automatic Lubricator For Precision Machines

Automatic lubricator uses a constant-pressure rotary pump to main-



SNYDER SEGMENTED IN-LINE TRANSFER MACHINE gages, air tests, machines, marks, and assembles seals in cast-iron automotive V-8 engine chain case covers at rate of 108 pieces per hour at 80% efficiency. 40-station, 65-ft machine is made up in eight segments, each having separate bases and control panels. Single transfer bar carries parts from station to station through the machine—*Snyder Tool & Engineering Co, 3400 E Lafayette Ave, Detroit 7, Mich*

Want more air for your money?

Check valve *on DeVilbiss compressor outfits securely seals air in tank. Manifold is finned for additional after-cooling; provides mounting for pressure switch, eliminating piping and additional tank openings.*

If you're losing on power, upkeep and depreciation, then it will pay you to replace your old air compressor with a new DeVilbiss outfit. By actual tests, you'll get as much as 22.6% more air per power dollar. DeVilbiss efficiency means high *actual delivery*.

In addition to check valves, every DeVilbiss compressor includes: A.S.M.E. approved tank, automatic pressure switch, diamond-bored pistons, cylinder head with removable valves, quality electric motor or gas engine.

Contact your local DeVilbiss jobber for help in analyzing your compressed air problems.

THE DEVILBISS COMPANY
Toledo, Ohio
Santa Clara, Calif. • Barrie, Ontario
London, England
Branch Offices in Principal Cities

FOR BETTER SERVICE, BUY
DEVILBISS

APEX IMPACT TOOLS

designed and built for use with POWER TOOLS...

...and equally suitable for use with HAND TOOLS

All Apex nut running tools are specifically designed and built for use with power impact tools. Precision machined from high carbon electric furnace alloy steels, these tools are cold broached and heat treated to withstand the severe shocks and strains of impact tool use.

The longer service life of Apex nut running tools has been proved on power tool applications in almost every industry. It follows, then, that even longer service life can be expected when Apex tools are used on standard hand tools, where service is not as rugged.

Either way—with power tools or hand tools, and on production or maintenance work—Apex nut running tools offer a freedom from quick wear-out and tool breakage that can only mean savings to you on your tool costs.

CATALOG 29-R lists more than 5,000 stock types and sizes of Apex nut running tools. Write, on your company letterhead please, for your copy.

APEX nut running tools

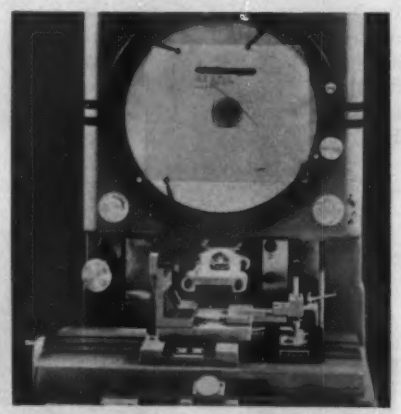
THE APEX MACHINE & TOOL CO.
1026 Patterson Blvd. • Dayton 2, Ohio

tain a continuous oil film of constant thickness on bearing surfaces in precision machines. Device eliminates film variation and excess oil drip resulting from other lubricating methods, according to manufacturer.

Rotary pump, which maintains pressure of 20 psi, contains plunger valve riding in eccentric groove and is mounted in a one-pint reservoir 3 x 4 x 4½ in. Lubricator shaft, operated at 1800 rpm, is driven from convenient shaft on machine or by direct-connected 1/20-hp motor. Pump shaft of 5/16-in dia contains eccentric groove 0.05 in. at deepest point in which spring-loaded plunger valve rides. As shaft rotates, oil is drawn in to "sweep area" of eccentric groove, carried around to opposite side, and then discharged into outlet line.

Lubricator has feed rate ranging from 0 to 27 cc of oil per minute, depending on rotation speed of shaft, number of lubrication points on machine, and fit of bearings.

Bijur Lubricating Corp, 151 W Passaic St, Rochelle Park, NJ



Reticle Tracing Fixtures Gage Odd-Shaped Parts

OGP coordinate tracer Model 49-H is designed to be used in conjunction with Kodak contour projectors to gage such configurations as hole locations in large castings, profile and timing of cam lobes, and die contours. Device combines tracing apparatus and reticle (one-to-one gage-outline reproduced on clear glass). As tracer moves over part, reticle, projected on screen and magnified to any size, moves through same path tangent to fixed reference circle. Because reticle reproduces part outline, part itself need not be projected. Projection is independent of part size, and any desired magnification can be used on projector.

Tracing range is 4 x 9 in. Tracer

"Control tower"

FOR YOUR INDUSTRIAL NEEDS

He co-ordinates hundreds of "arrivals" and "departures" every day. With the sure accuracy of long experience he brings 'em in and sends 'em out—*on time.* In emergencies, his specialized knowledge can save the day. His job, complex and fast-moving, is devoted to a single purpose: serving you. *This man is your Industrial Distributor.*

HOW THE INDUSTRIAL DISTRIBUTOR HELPS YOU MAKE MORE AND BETTER PRODUCTS AT LOWER COST

• He helps you keep your costs "on the beam." According to the authoritative magazine, *Industrial Distribution*, he saves you more than $10 out of every $100 you spend annually for supplies and equipment. Your Industrial Distributor assumes for you the expenses of office overhead, insurance, depreciation, etc., that you would have to pay if you stocked for yourself the items he supplies.

• He simplifies your industrial purchasing. A single, convenient source for all your needs, he's as easy to reach as your telephone. And he saves you time and expense by keeping you posted on new developments and tracking down hard-to-find items for you.

• His advice is sound and his delivery of needed equipment speedy. Count on him in time of trouble, as a pilot does on an airport tower, to help keep your plant humming smoothly.

• He saves money for the firms who make the supplies and equipment you buy, just as he saves money for you, by reducing their costs of inventory and distribution. Result: lower prices than if you bought direct from these suppliers.

Imagine an airport without a control tower, where every plane had to call every other plane! Imagine the hopeless confusion of Industry, where every industrial consumer had to deal directly with every supplier for his needs. That's why Nicholson File Company firmly believes that the Industrial Distributor way of marketing gives you the best service at the lowest cost. We have marketed exclusively through distributors for more than 40 years.

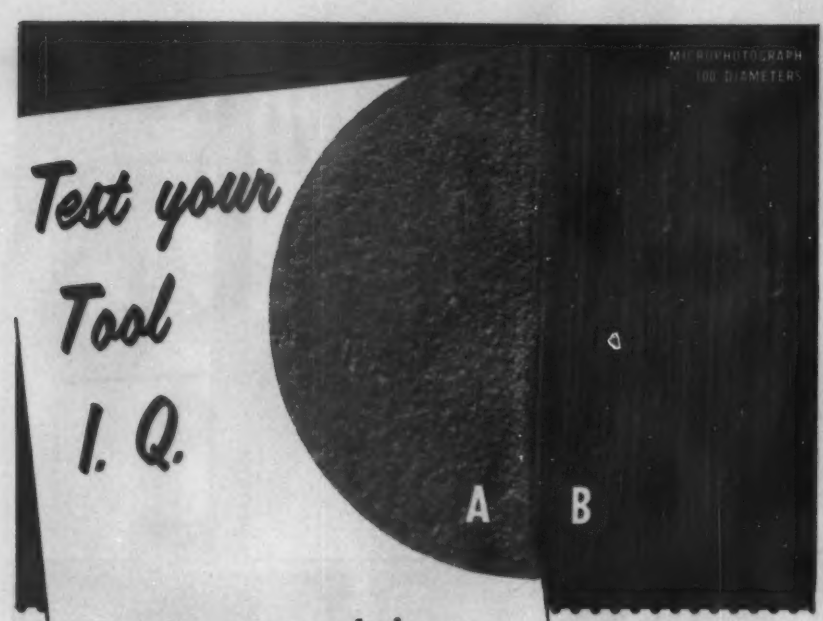
Your Industrial Distributor's field men have highly specialized knowledge of files and filing. Are you taking fullest advantage of their sound technical advice?

NICHOLSON FILE COMPANY

Providence, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

World's foremost manufacturer of A FILE FOR EVERY PURPOSE

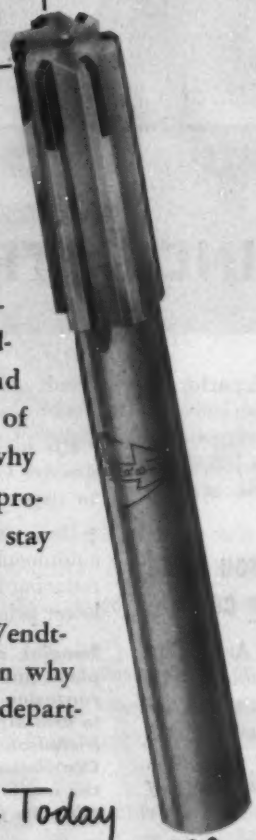


Test your Tool I. Q.

Which tool finish is 30% smoother? A( ) B( )

ANSWER: Profilometer readings show that finish A — Wendt-Sonis' new Flo-Finish — is 30% smoother than B, the ground finish usually used on round tools. Note how Flo-Finish eliminates marks left by grinding. Without grinding marks and other irregularities, chips move out of flutes quickly and smoothly. That's why smooth Flo-Finish tools cut faster, provide a better finish on work, and stay sharp much longer.

Smooth Flo-Finish is applied to all Wendt-Sonis round tools — one more reason why W-S tools are higher quality. Write department AM-1155 for bulletin.



Mail Coupon Today

WENDT-SONIS COMPANY
Hannibal, Missouri

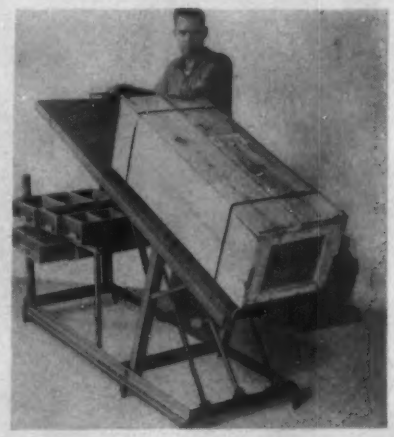
WENDT-SONIS COMPANY
Dept.
HANNIBAL, MISSOURI
Send me Catalog with full data on new Flo-Finish.

NAME
FIRM
ADDRESS
CITY ZONE STATE

probe is adjustable vertically for proper depth setting. Reticle retaining frame accommodates 4¼ x 9¼-in. glass.

Four standard reticle tracer units are available. Bulletins from manufacturer.

Optical Gaging Products, Inc, 26 Forbes St, Rochester, NY



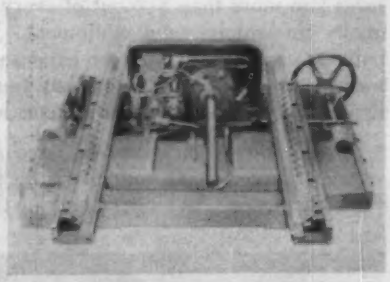
Hydraulic Packing Bench Tilts Boxes to Floor

Hydra-Tilt table has hydraulic cylinder incorporated in its design that allows operator to tip load from table automatically by means of a control lever. Boxes weighing up to 1000 lb can be tilted to floor from packing bench.

3-in. height adjustment of table can be made to suit operator's convenience. Several drawers are built in to provide storage space for tools and packing material. Table size is 24 x 72 in.

Cylinder which operates table requires no source of power other than load being handled; closed hydraulic system controls tilt through bypass operated by single valve.

Valley Craft Products, Inc, 750 Jefferson Ave, Lake City, Minn

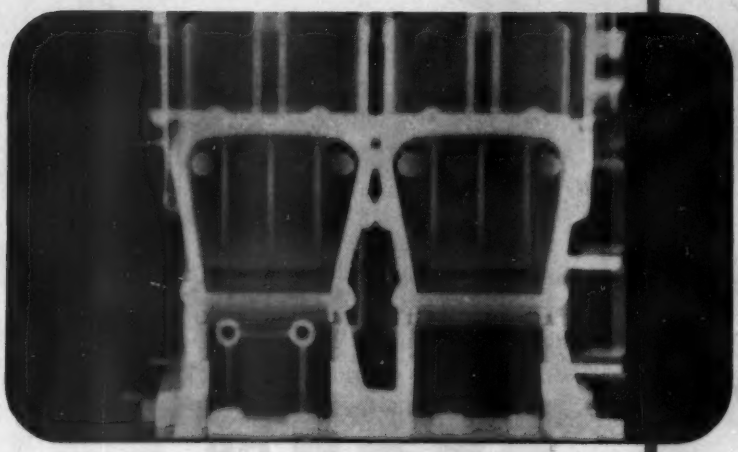


Feeding Saddle Has Ball-Bearing Ways

Surface grinders in company's Hydrabrasive line are equipped with

(Continued on page 210)

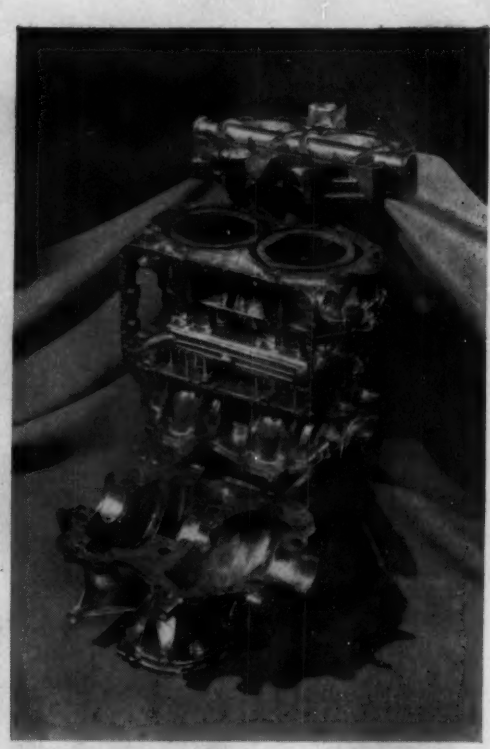
Dependability is a must . . . so



RADIOGRAPHY keeps its eye on production

Radiography . . .

another important example of Photography at Work.



SALES of outboard motors have gone up dramatically. New high power, smoothness, and quiet have all helped. But chief of their outstanding virtues is dependability.

This quality is guarded by radiography. It insures soundness of castings—sees that weakness is not lurking in a hidden flaw.

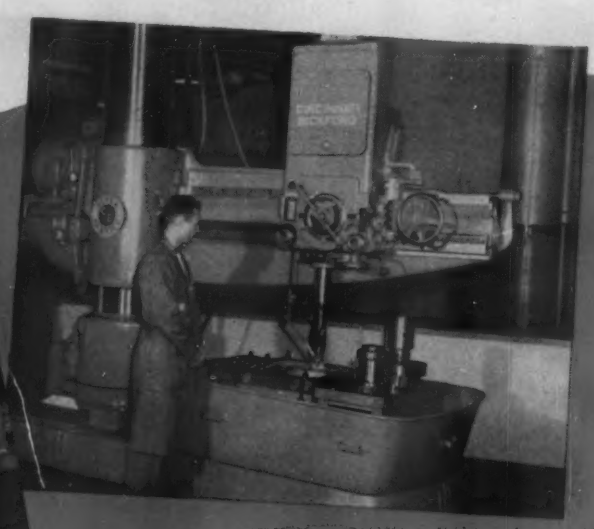
Radiography cuts cost, too, when x-rays reveal unsatisfactory castings before machining is begun.

Today radiography is playing a greater and greater role in good foundry operations. It frequently points the way to better casting methods . . . makes sure only sound castings are delivered.

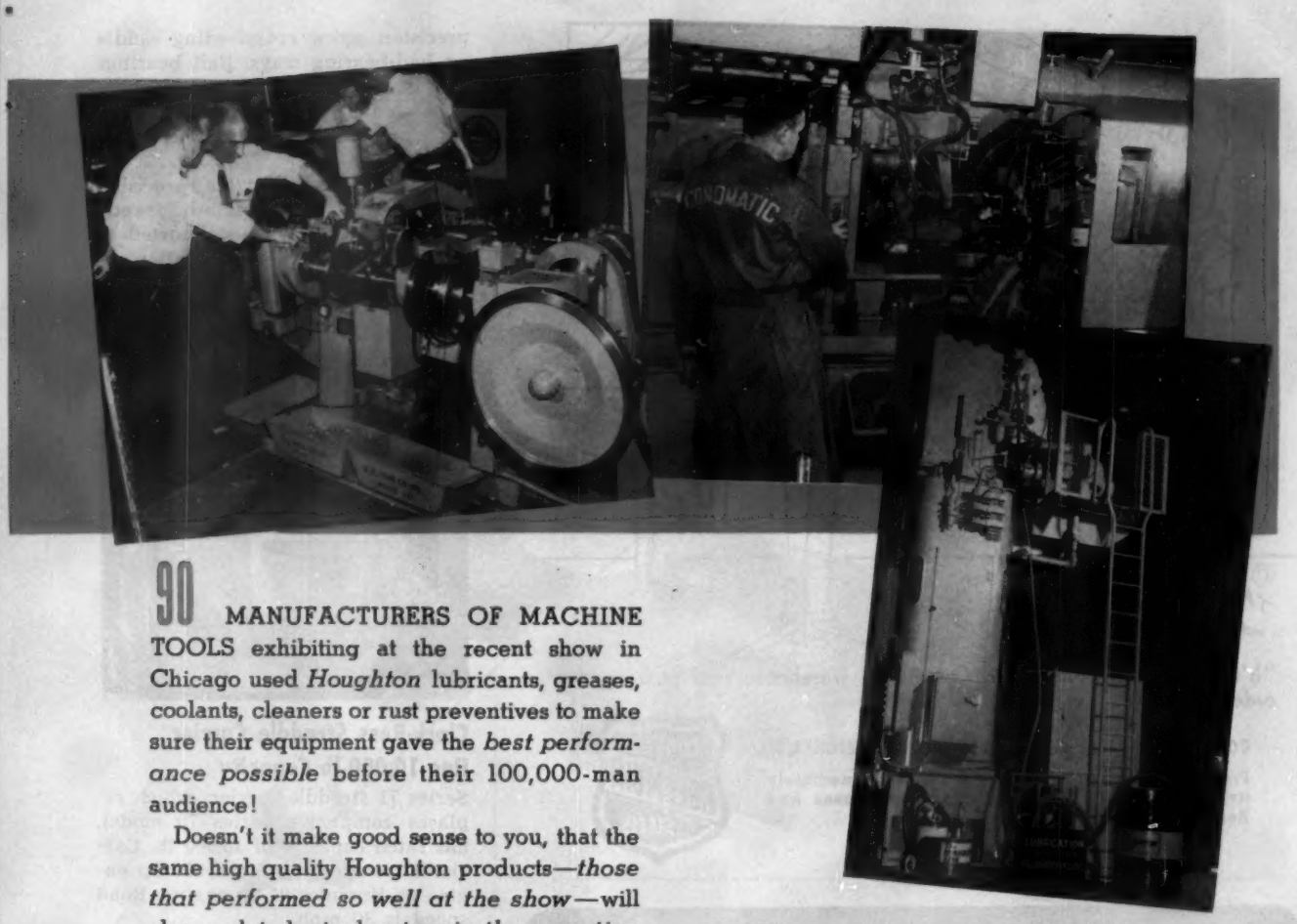
If you'd like to know how radiography can help you, get in touch with your x-ray dealer. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

Kodak

EASTMAN KODAK COMPANY, X-ray Division, Rochester 4, N.Y.



90 machine tool exhibitors can't be wrong!



90 MANUFACTURERS OF MACHINE TOOLS exhibiting at the recent show in Chicago used *Houghton* lubricants, greases, coolants, cleaners or rust preventives to make sure their equipment gave the *best performance possible* before their 100,000-man audience!

Doesn't it make good sense to you, that the same high quality Houghton products—*those that performed so well at the show*—will also work to best advantage in *the operation of your machine tools?*

Ask the Houghton Man for more details on the efficient, cost-saving products listed here and you'll want to follow the lead of the 90 manufacturers by specifying HOUGHTON, too.

Or—write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. for latest bulletins on these popular products.

- **"Antisep" Coolants and Cutting Oils** for dependable, low-cost machining
- **"Houghto-Grind"** for most efficient, oil-free grinding—rust inhibitive
- **"Houghton Way Lubricants"** that prevent excessive wear—won't "slip-stick"
- **"Houghto-Clean"** for production-line cold cleaning of metals—eliminates heat
- **"Hydro-Drive" Fortified Hydraulic Oils** with exceptional film strength and stability
- **"Rust-Veto"** for maximum prevention of rust and corrosion—indoors or outdoors

. . . products of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

"It's an emergency! Go to Columbia's warehouse and pick up our order for ATMODIE SMOOTHCUT!"

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

Another of the Reasons Behind Brad Foote Quality—

DEBURRING

• Deburring of gears isn't normally included in specs or drawings. And we don't get paid for it. But here at BRAD FOOTE we take pains and expend many man hours on deburring—for we know that one tiny burr can ruin a $100,000 machine.

• Examine your next shipment of gears. See whether your present supplier is painstakingly removing all the burrs. Find out how many hours your assembly department has had to charge against deburring. See another way in which BRAD FOOTE quality and extra attention to details saves you money.

• Prove to yourself the savings that BRAD FOOTE quality can mean. Let us quote on the gear requirements for your next program—whether it be radar equipment, diesel engines, etc. BRAD FOOTE has experience in providing gears for almost every specialized application and would welcome the opportunity of discussing your gear problems.

BRAD FOOTE MAKES ALL TYPES OF GEARS— IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.

1309 South Cicero Avenue • Cicero 50, Illinois

Bishop 2-1070 • OLympic 2-7700 • TWX CIC-2856-U

subsidiaries | AMERICAN GEAR & MFG. CO. Lemont, Illinois Phone Lemont 920 | PITTSBURGH GEAR COMPANY Phone SPalding 1-4600 Pittsburgh 25, Penn.

precision screw crossfeeding saddle on ball-bearing ways. Ball bearings roll in square rather than V channels, so that table rocking and excessive wear are said to be eliminated.

Saddle feed screw is precision ground and has backlash takeup nut. Hydraulic drive is reported to provide vibrationless operation to table feed and saddle feed screw.

Abrasive Machine Tool Co, East Providence, RI

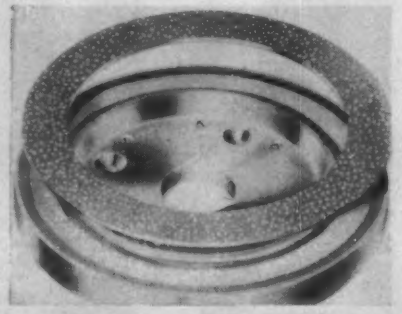
Clark-Ross Straddle Carrier Has 10,000-lb Capacity

Series 71 straddle carrier, which replaces company's Series 70 model, has rated capacity of 10,000 lb. Carrier is powered by Ford 130-hp engine or Hercules 91-hp engine. Road speed is 30 mph.

Features include syncromesh transmission with three speeds forward and reverse; hoist mechanism actuated by double-acting hydraulic cylinder; and radi-arc steering which gives model the shortest turning radius of any carrier now available, according to manufacturer.

Model is available in nine models capable of carrying loads ranging from 42 to 54 in. in height and 40 to 52 in. in width.

Ross Carrier Div, Clark Equipment Co, Benton Harbor, Mich



Magnetic Chuck Has Removable Diamond Rings

Model MC4508 magnetic diamond-

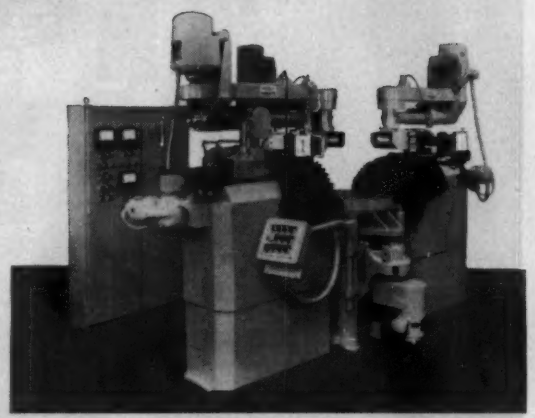
(Continued on page 214)

New standard in finishing

EXTREME temperatures and stresses set up in jet engines cause unprecedented strains on metal components.

Fatigue and failure producing concentrations of stress in a ring component—sections shown above—are eliminated by blending surface junctures with Osborn Brushamatic power brushing. Replacing undependable hand methods, power brushing produces the highest quality finish ever achieved. It speeds up production and inspection . . . eliminates rework.

It will pay *you* to have an **O**sborn **B**rushing **A**nalysis made of your finishing operations. Write *The Osborn Manufacturing Company, Dept. C-39, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn's 51-3L Brushamatic cleans and finishes metallic and non-metallic parts up to 8 feet in diameter, 3500 pounds in weight

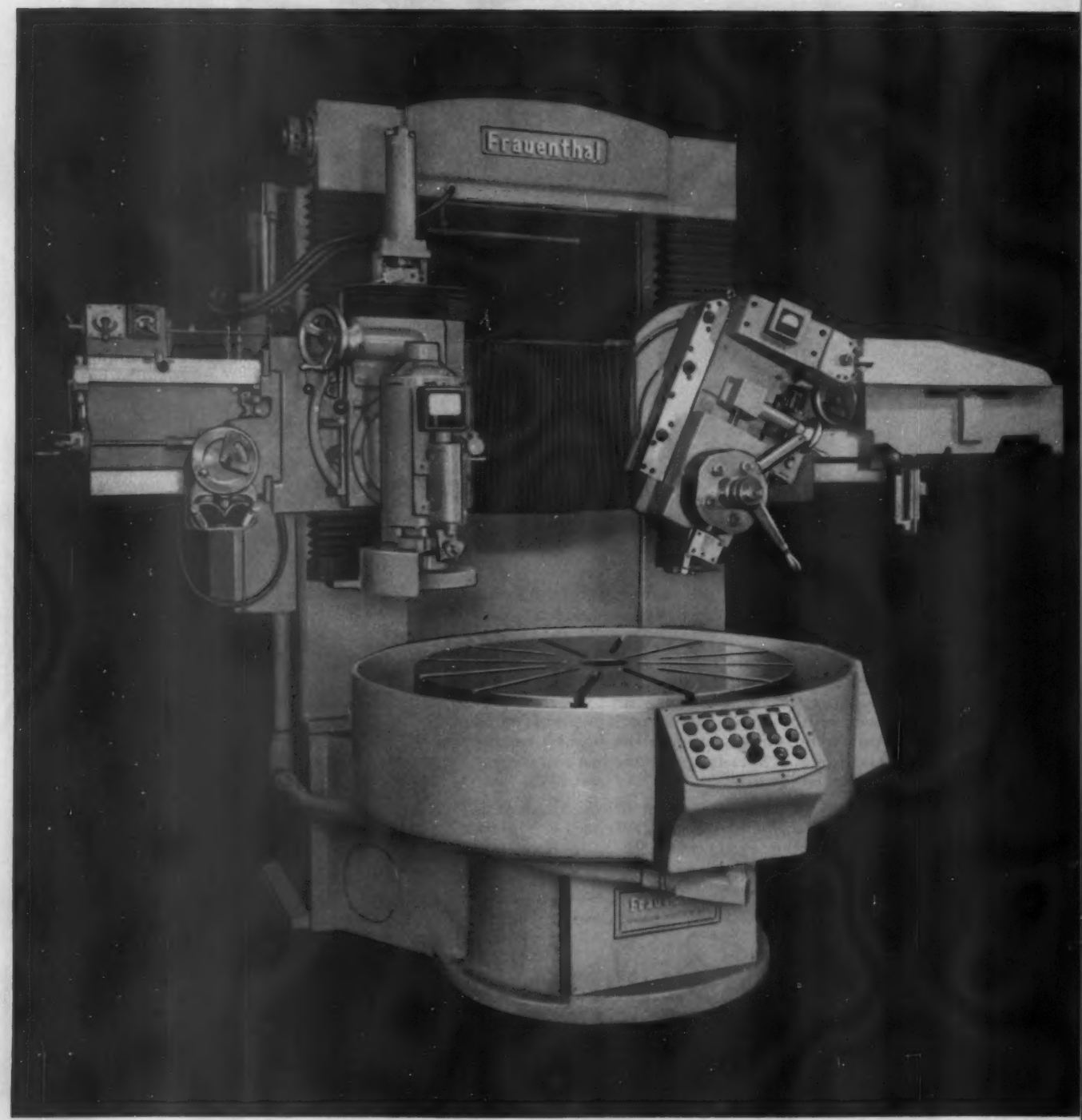
COMPLETE DATA—For information on power brushes and brushing methods write today for Osborn's Catalog 300.

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

CAN YOU
to .000200" accuracy



turn, bore and grind in a single set-up?

The Frauenthal 3100 Series offers this precision and versatility with these cost-cutting features

1. Utmost versatility — Both grinding compound and turret slide can be swiveled to meet practically any angular requirement.

2. Super-precision performance — Only a Frauenthal grinds related surfaces to accuracies within .000200", producing consistently uniform precision in concentricity, parallelism and roundness.

3. Horizontal table — Loads easier and faster than vertical face plates. Horizontal table also provides greater stability for large, heavy parts.

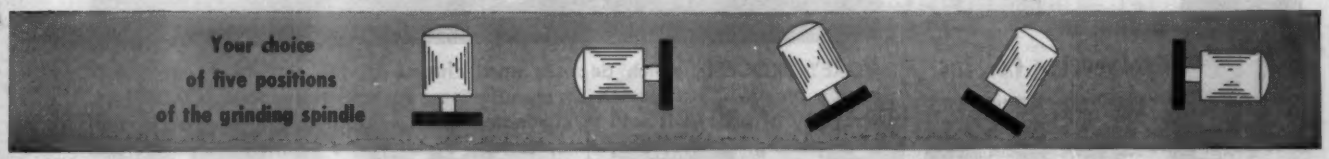
4. Simplified tooling — Horizontal table permits simpler fixtures, particularly for thin-section jet engine parts, plus economy of dual purpose tooling for turning and grinding.

5. Convenient controls — All operating controls are easily within the operator's reach for quick selection of feeds and speeds. Electrical interlocks are provided for utmost safety.

6. Contour turning — Hydraulic duplicator attachment (turning head) performs tracer controlled turning operations most accurately and performs repetitive operations at lower cost.

May we help you?

If you'd like further information on how the 3100 Series precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.



Frauenthal Division · KAYDON ENGINEERING CORP. · Muskegon, Michigan

tough sprayed metal

well-known maintenance method now profitable production process

equipment fabricators find tough, high-quality sprayed metals build big bonus pay-offs

Modern metallizing—metal spraying—which for many years has saved millions of maintenance dollars by restoring worn machine parts for thousands of companies, is now helping many others improve their products, cut production costs.

In the production of new equipment, tough sprayed metal coatings provide highly desirable mechanical or electrical characteristics at low cost, in high speed, semi-automatic production.

General Electric, for example, a long-time user of metallizing to provide superior wearing qualities on critical areas of large turbine shafting, now applies sprayed metals to a wide range of its products. Many forward-looking companies have instituted investigative programs in their research and design labs to explore the use of metallizing as a means of giving their products competitive advantages in quality, or performance or price—or all three.

Metallizing may be able to help your company improve its products, economically, reduce machine maintenance costs, cut your bills for corrosion protection. It may pay you well to look into it. In any event you will find it a fascinating subject. Bulletin 51 illustrates and describes "Metallizing—its practical applications"—shows actual work being done in users' shops. We shall be happy to send you a copy.

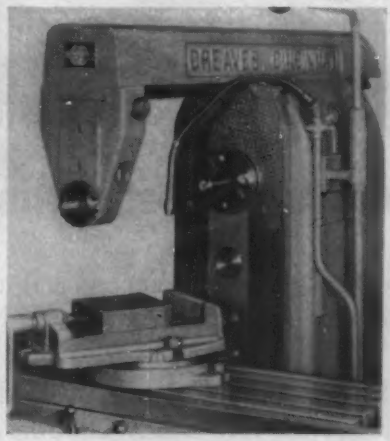
METCO®

Metallizing Engineering Co., Inc.

1169 Prospect Ave., Westbury, L. I., New York
Telephone: EDGEWOOD 4-1300 • Cable: METCO
In Great Britain: METALLIZING EQUIPMENT COMPANY, LTD. — Chobham near Woking, England

ring holder is designed to become a permanent part of the grinder. Once the holder is trued, it holds single layer or impregnated diamond rings in place by magnetic force. Rings can be removed by inserting screwdriver under the ring edge. The magnetic chuck is 6 in. in diameter with provision for handling ¾-in. rings. Chuck is priced at $45.00.

Super-Cut, Inc, 3418 N Knox Ave, Chicago 41, Ill



Greaves Swivel-Base Vise Graduated From Master Index

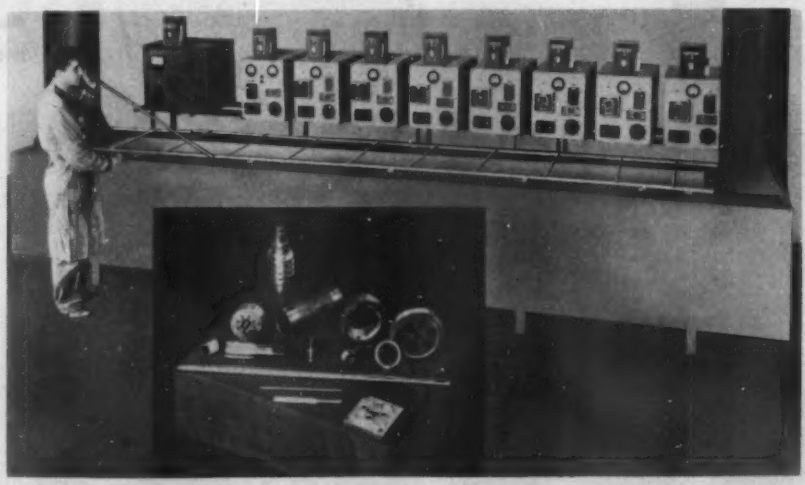
Heavy-duty swivel-base vise is made to hold all types of small workpieces. Unit, made of semi-steel castings, is graduated through 180° from master index plate, and is of low height, to give maximum vertical clearance.

The base may be removed from the vise by loosening two bolts, and may be used as a plain vise. Removable jaw facings are of hardened alloy steel. Milled keyways provide for alignment of vise to milling table.

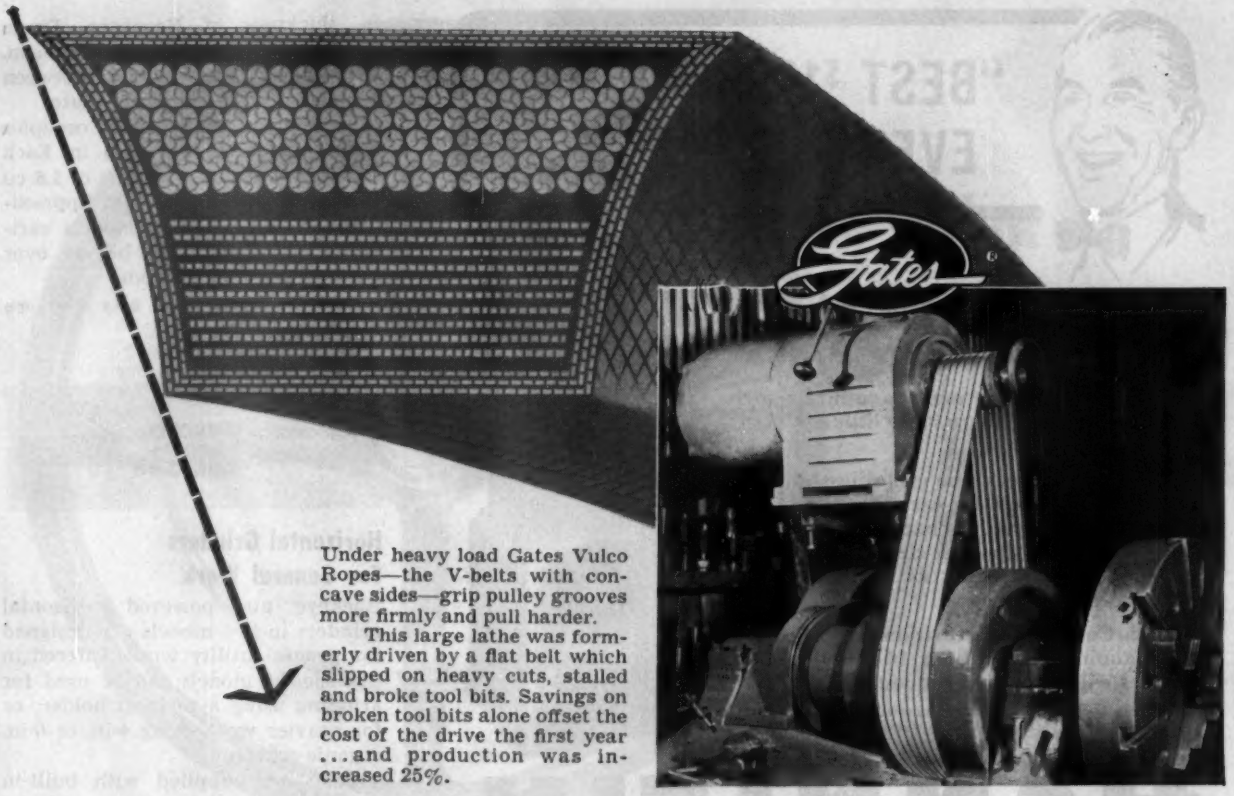
The Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio

Heavy-Duty Barrel For Precision Finishing

Lorco Model 200 barrel-finisher for stamped, forged, machined or cast parts is powered by a 1-hp motor. Compartments are lined with a ¼-



MOREY PROCESS, which deposits hard chrome at the rate of 1 mu-in. per minute on parts, is reported by manufacturer to hold tolerances to 0.0001 in. Accuracy of process is said to eliminate need for lapping, grinding, or waxing after plating. Control over time, current density, and solution temperature is obtained with synchronous motor and thermostats. A special selenium rectifiers is designed to ripple factor to less than 5% — *Chrome Electro-Forming Co, 7515 Lyndon Ave, Detroit 21, Mich*



Under heavy load Gates Vulco Ropes—the V-belts with concave sides—grip pulley grooves more firmly and pull harder.

This large lathe was formerly driven by a flat belt which slipped on heavy cuts, stalled and broke tool bits. Savings on broken tool bits alone offset the cost of the drive the first year ...and production was increased 25%.

Concave sides keep belt costs down!

Industry is saving thousands and thousands of dollars every year by specifying Gates Vulco Ropes—the V-Belts with *concave sides* (U.S. Pat. No. 1813698).

Here's the interesting reason *why* Gates belts save money:

On the bend around the sheave the *precisely engineered* concave sides (Fig. 1) of the Gates belt fill out and become straight (Fig. 1-A). Thus the belt makes uniform contact with the sides of the pulley. That means sure pulling power and *even distribution of wear*. Longer wear, fewer replacements cut belt costs...reduce down time...contribute to profits.

Simple test proves value of concave sides

Bend a straight-sided belt (Fig. 2) and feel the sides *bulge out* around the bend. The bulging sides prevent the belt from fitting evenly in the pulley groove (Fig. 2-A). Uneven contact causes uneven wear...shortens belt life...increases costs.

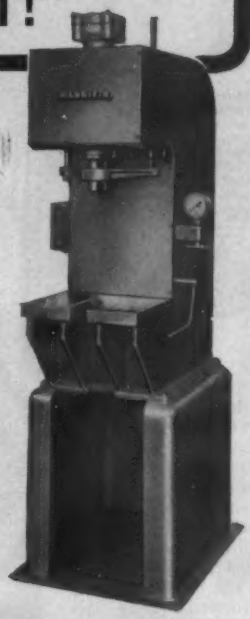
Keep belt costs *down* by specifying Gates Vulco Rope Drives—the V-Belt with *concave sides*. Belts you need are readily available from nearby distributor stocks. The Gates Rubber Company, Denver, Colorado—*World's Largest Maker of V-Belts.*

Gates Engineering Offices and Distributor Stocks are located in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 25-A

GATES VULCO ROPE DRIVES

"BEST $1286 WE EVER SPENT!"



That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

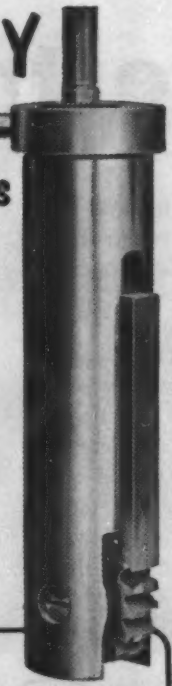
WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

Hannifin Corporation, 517 S. Wolf Road, Des Plaines, Illinois

The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed Rockwell hardened steel, accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

national

MACHINE TOOL CO.

CINCINNATI 22, OHIO

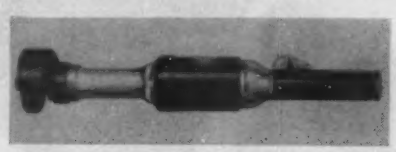
WRITE TODAY

for Catalog No. 17 complete, handy size

in. thickness of Neoprene. Drum ends and wrapper sheet are of ¼-in. steel plate, and divider between compartments is of ⅜-in. plate.

Finisher is 48 in. high, occupies a floor space of 31 x 38½ in. Each compartment has a volume of 1.6 cu ft and will hold a load of approximately 250 lb. The machine's variable-speed drive may be set over a range of 8 to 40 rpm.

Lord Chemical Corp, 2068 S Queen St, York, Pa



Horizontal Grinders For General Work

Buckeye air - powered horizontal grinders in two models are designed for general utility work. Offered in five speeds, models can be used for grinding using a toolpost holder, or for heavier work using 4-in. or 6-in. organic wheels.

Tools are supplied with built-in muffler, designed to exhaust noise.

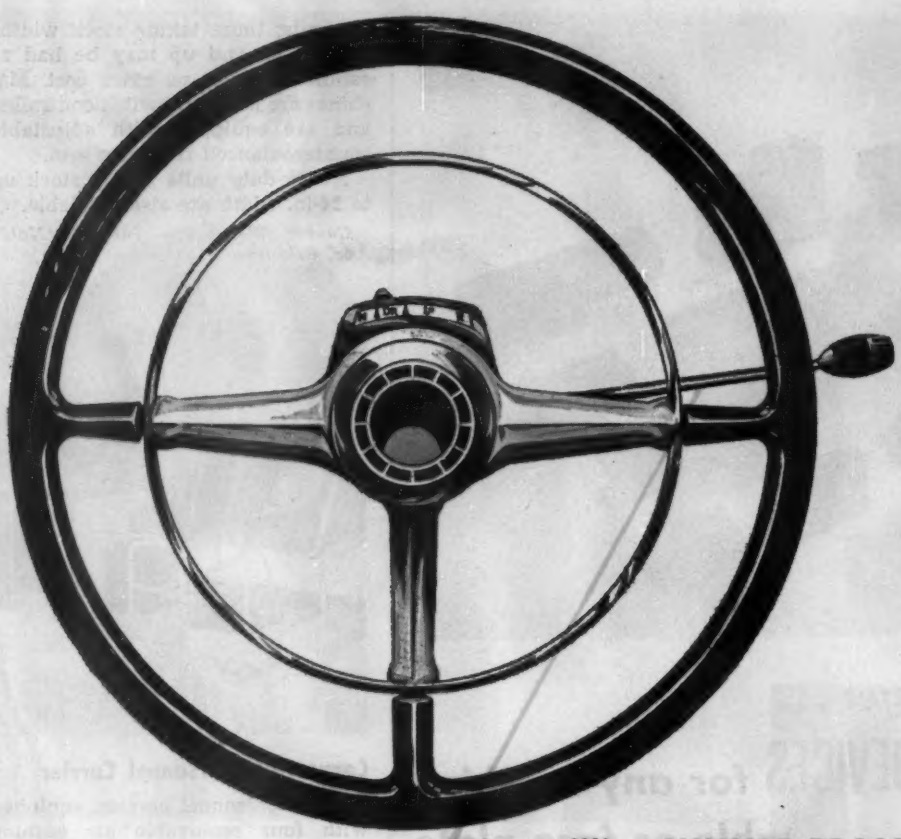
Available with ⅜ in.-24 or ½ in.-13 spindle, tools are also adaptable for wire brush and for use with abrasive rolls. Grinders are equipped with "C" Series air motors.

Buckeye Tools Corp, Div 15, P O Box 966, Dayton 1, Ohio

Cooper Weymouth Straightener Takes 12-in. Stock

Motorized stock straighteners for plant press rooms are available with constant or variable-speed drives. Models are manufactured in a variety of sizes to take stock in widths from 2½ in. up to 12 in. and with 5, 7, or 9 straightening rolls.

All models are available as pedes-



How a shift in gears saved $256,000

Five million MUELLER BRASS CO. forged ring gears improve automatic transmission operation . . . at lower cost to the manufacturer.

Ever since one of the leading manufacturers of automotive transmissions began using ring gears forged from Mueller Brass Co. bearing bronze, production costs have been cut nearly $256,000. That's because the rough forging weighs less and is closer to finished size than a sand cast ring gear formerly used. This shift in gears resulted in a savings in metal costs, greatly reduced machining time and increased tool life. In addition, the use of forged gears has cut scrap loss and eliminated costly inspection rejects.

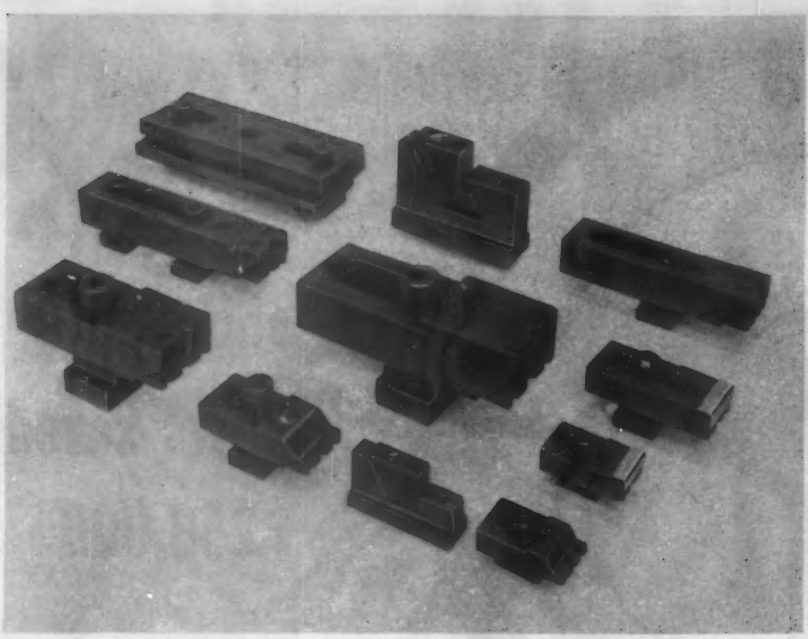
The performance of these forged ring gears is also far superior to the sand cast gear, which had a tendency to flake away and crack around the teeth, causing failures. More than five million forged ring gears have now been used in these transmissions without a single failure. Being porous, the sand casting was difficult to balance, but the forging has a dense, homogeneous structure that helps keep it in perfect balance.

Strong, long-wearing non-ferrous metal parts, forged to your specifications by Mueller Brass Co., can help reduce your costs and improve the performance of your products just as they have done in this transmission application. For complete information, write us today.

Write today for your complete set of Mueller Brass Co. engineering manuals.

MUELLER BRASS CO. PORT HURON 23, MICHIGAN

154



Where you can get ...

DOWN-HOLDING DEVICES *for any machine table or face plate*

J & S All-Purpose Jaw Clamps eliminate U-Clamps, Straps and Fingers for lathes, planers, milling machines, boring millers, jig borers, etc.

Faster Set-up with any of the 5 Models of J & S Jaw Clamps —one adjusting screw has a holding force of 2½ tons on the Small Model, to 12 tons on Jumbo Model for positioning and holding the work-piece.

Single powerful clamping action obtained from the 45° angle inward and downward movement of the jaw clamp is easily applied and controlled.

Compact, efficient design of J & S Jaw Clamps eliminates the usual obstruction problems—no interference with measuring tool readings.

The *only* hardened and ground *Swivel* Vise that Mounts Low—Swivels—No Pedestal.

See your industrial distributor or write today for free literature.

J&S TOOL CO. INC. — JAW CLAMPS • PRECISION VISES • DOWN-HOLDING DEVICES

CLAMPCUT one basis

J & S TOOL CO., INC.

871 DORSA AVE.
LIVINGSTON, NEW JERSEY

tal units; those taking stock widths from 6 in. and up may be had as cabinet units at no extra cost. Machines are mercury-switch controlled and are equipped with adjustable counterbalanced free loop arm.

Heavy-duty units taking stock up to 24-in. width are also available.

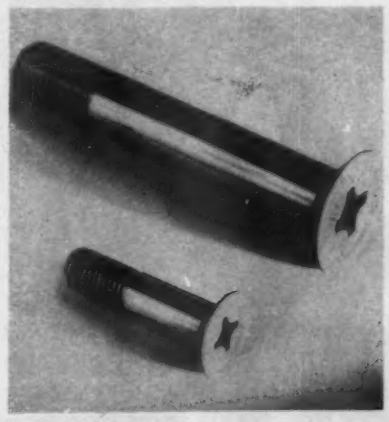
Cooper Weymouth, Inc, 277 Noble Ave, Bridgeport 8, Conn

Convertible Personnel Carrier

Electric personnel carrier, equipped with four removable air cushion seats, can also be used for delivering miscellaneous freight throughout the plant.

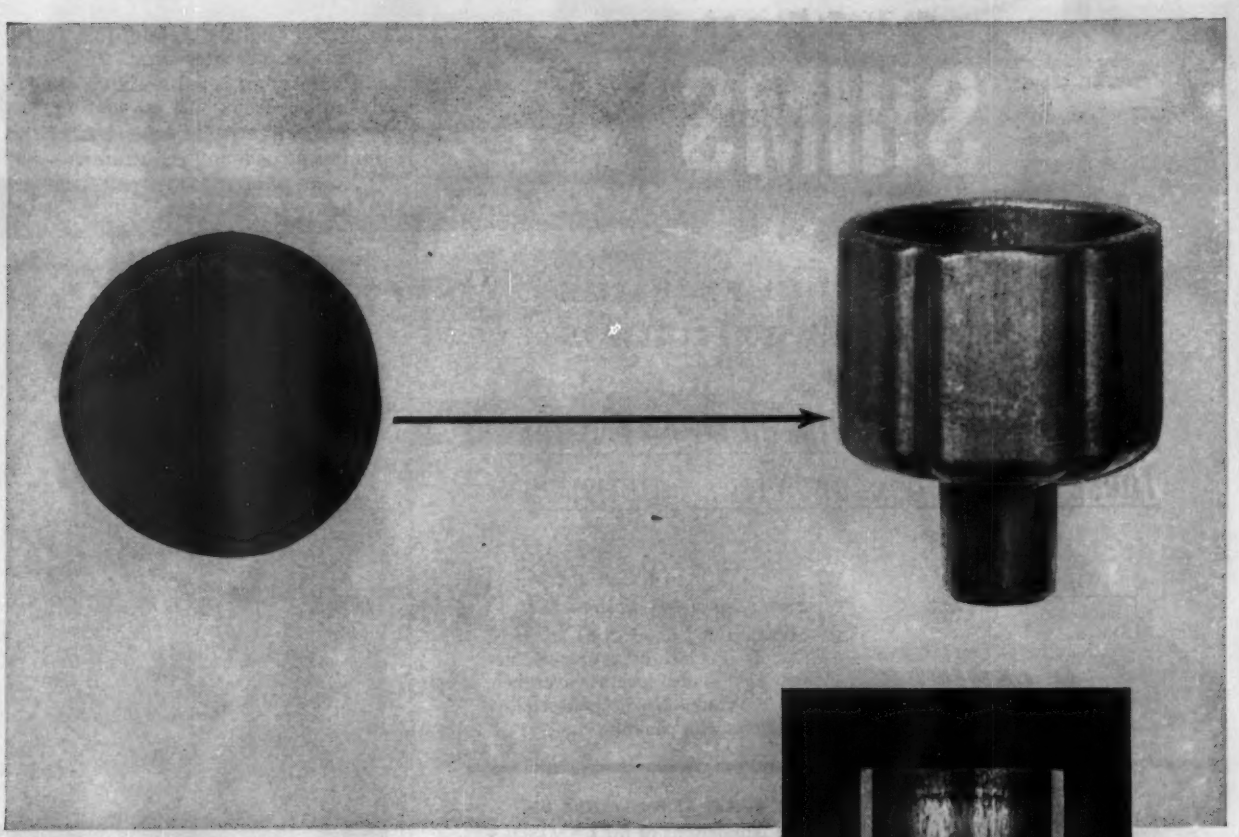
Operator can stand, or sit on the battery compartment. Braking and controls for three speeds are on the floor. Deck of the 2000-lb capacity truck is 54 in. long, 40 in. wide, 9½ in. off the floor. Top speed is 6 mph.

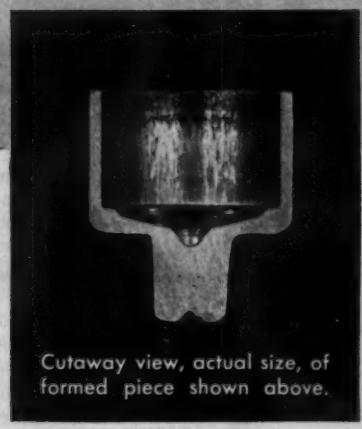
Lewis-Shepard Products, Dept R-27, Watertown, Mass



Titanium Flush-Head Bolt

SPS Hi-Ti 100° flush head bolt, an NAS-333 series type aircraft fastener fabricated from a 4% aluminum, 4% manganese alloy of titanium, can be substituted directly for conventional





Cutaway view, actual size, of formed piece shown above.

COLD FORMED IN ONE OPERATION —with Bonderite and Bonderlube!

An experienced production man looked at this blank and the formed parts and said flatly, "It can't be done!" But *it is being done* — in one operation — on a production basis of thousands of units per day.

The blank is treated with Bonderite, and then with Bonderlube. This combination works with remarkable effectiveness.

These two Parker products effect big savings in other ways besides raising production levels. Tool and die breakage declines sharply, fewer process anneals are necessary, operation is simplified, scrap is minimized, and machining operations are reduced.

Cold extrusion, with Bonderite and Bonderlube, may hold the key to cost-cutting for you. Write for information!

*Bonderite, Bonderlube, Parco, Parco Lubrite, Parker Pre-Namel—Reg. U.S. Pat. Off.

Since 1915—Leader in the Field

1915 40th year 1955

PARKER RUST PROOF COMPANY

2196 E. Milwaukee, Detroit 11, Michigan

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

SHIMS

BRING YOUR SHIM PROBLEMS TO EXPERIENCED SPECIALISTS

●

Only LAMINATED SHIM COMPANY Offers These Efficient, Economical Solutions:

THE LAMINUM® SHIM

SIMPLY PEELS FOR ADJUSTMENT

Made up of from 3 to 63 layers of .002 or .003 inch brass or steel, metallically bonded together over their entire surfaces. No dirt between layers. Peels with penknife.

THE LAMISOL® SHIM

FOR QUICK, ASSEMBLY LINE USE

The laminations of the LAMISOL® Shim (in brass) are temporarily joined by spot-soldering on the edges. Gauges and number of laminations within one shim are unlimited.

PACKAGED SHIM STOCK

READY FOR EASY USE, WITHOUT WASTE

Thin gauge 6" x 100" rolls feed through package slots. Heavier gauges in flat envelopes. Available from your Industrial Distributor.

LAMINUM® and LAMISOL® Shims are also made of ALUMINUM; layers are .003".

FLASH! *LAMINUM® now available in STAINLESS STEEL with layers of .002" or .003".*

LAMINATED SHIM COMPANY, INC.

SHIM HEADQUARTERS SINCE 1913

Check Our Stampings Division For Your Stamped Parts Requirements

MAIL TODAY!

LAMINATED SHIM COMPANY, INC.
3111 UNION STREET, GLENBROOK, CONN.

Please send me more information on:

☐ SHIMS ☐ STAMPINGS ☐ BOTH

☐ *We'd like to discuss our problem with one of your Sales Engineers.*

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

alloy steel bolts weighing 75% more.

Testing indicates that the ¼-in. and ⅜-in.-dia bolts have shear strengths of 113, 470 psi and 108,695 psi respectively, far in excess of the minimum shear requirements of 95,000 psi for this type of fastener. Bolts are available from ¼ to ½-in. dia.

Standard Pressed Steel Co, Jenkintown, Pa

Face Mask's Design Increases Visibility

Scottoramic face mask incorporates the wrap-around windshield design, eliminating two separate eye-pieces. Visibility through the plastic safety lens is reportedly unlimited.

Non-fogging is accomplished by circular air-washing action of cool air or oxygen supply. Double lip seal insures comfort. Mask, which can be put on with one hand, can be worn over glasses. Microphone and air hose are optional equipment.

Scott Aviation, 437-P Erie St, Lancaster, NY

Atkins Chamfer-Tooth Blade For Hacksaw Metal-Cutting

Reportedly adaptable to precision cutting, chamfer-tooth blade is said

(Continued on page 224)

1st in a Series . . .

OF HIGH PRODUCTION CASE HISTORIES

ASK BAIRD ABOUT IT

Before and after views of the machining operations performed on the Baird 76H Automatic Chucking Machine.

8 OPERATIONS ON HEAD CASE

OF COLD DRAWN MILD STEEL

Production . . .

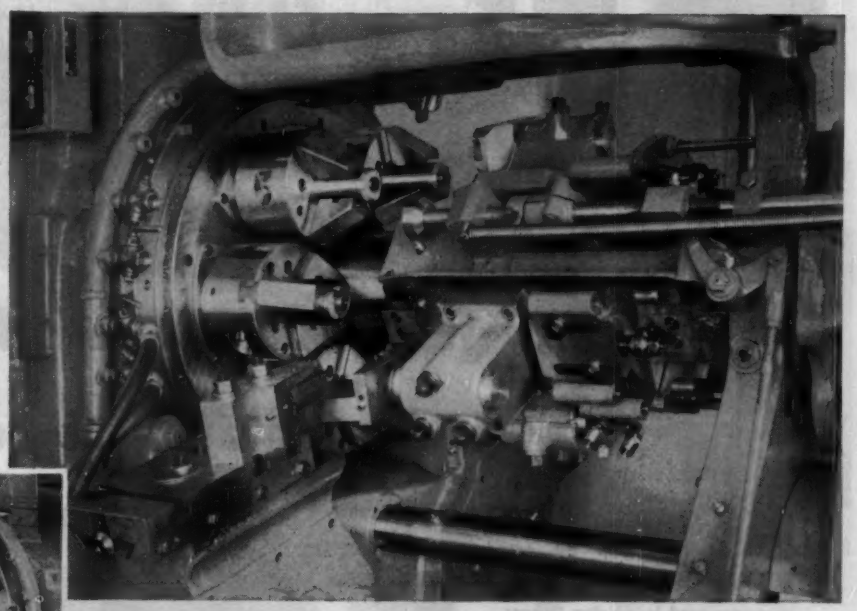
198 PIECES PER HOUR

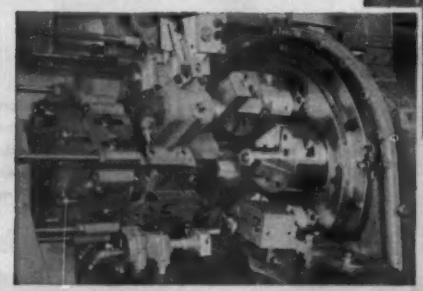
The machine tooled for production of these parts at extremely low cost is the Baird 76H Automatic Chucking Machine.

Operations are: rough and finish turn the smaller O.D. . . . face the shoulder . . . rough and finish larger O.D. for threading . . . face the end, cut recess for threading die and chamfer the ends. Prevention of tool marks on the finished surfaces is assured by indexing the work away from the tools at the conclusion of the cutting.

Even though you may not have Head Cases to finish, there are many similar jobs that can be produced at most favorable competitive costs on the Baird Chucker with high speed tooling set-ups.

"Ask Baird about it." Write Dept. AM.





***(Above)* Front view of tooling showing 4 of the 6 chucks. *(Left)* Rear view of the tooling.**

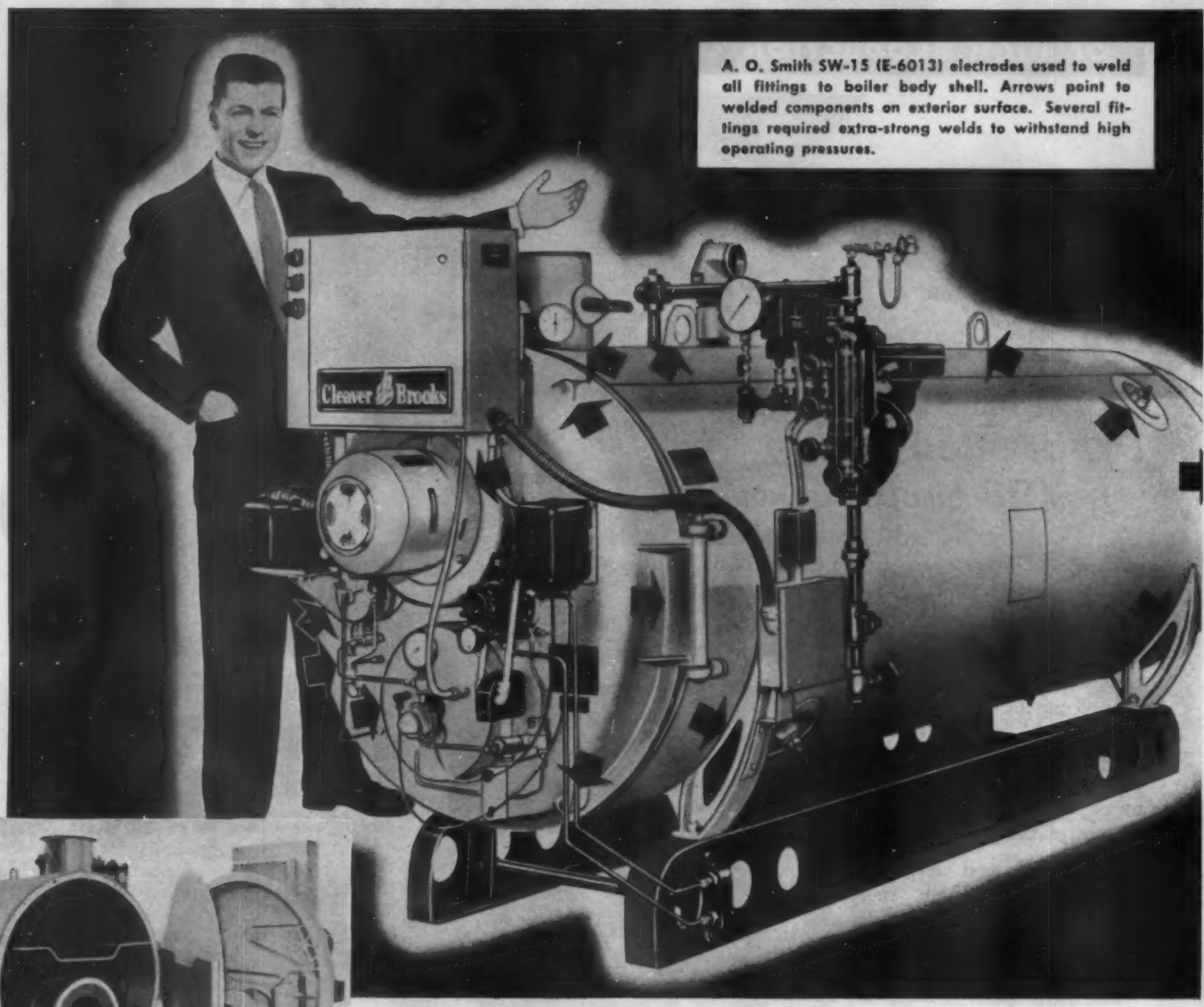
THE BAIRD MACHINE COMPANY

STRATFORD CONNECTICUT

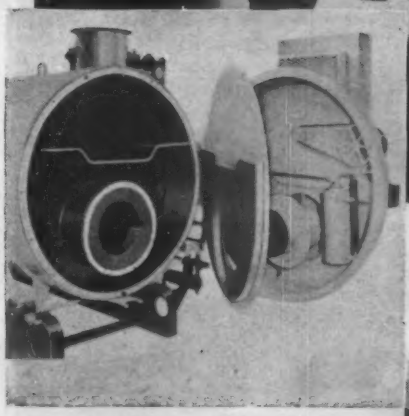
WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC BORING TOOLS • AUTOMATIC BAR & TURRET LATHES • FORMING MACHINES • AUTOMATIC SPECIAL & TURNING MACHINES

For their NEW "packaged" boiler Cleaver-Brooks

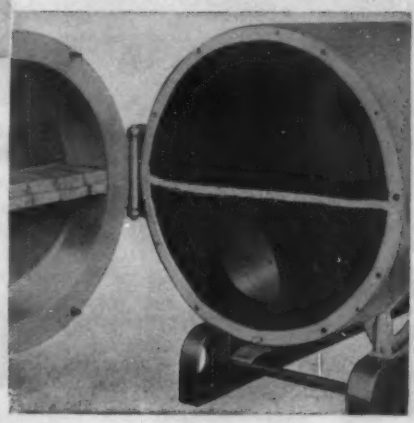


A. O. Smith SW-15 (E-6013) electrodes used to weld all fittings to boiler body shell. Arrows point to welded components on exterior surface. Several fittings required extra-strong welds to withstand high operating pressures.



A. O. Smith SW-44 (iron powder) electrodes used in welding flanges on front head (top) and rear door assemblies. Because slag peels as they weld, SW-44 electrodes virtually eliminate clean-ups.

America's top-line welding electrodes!



SW-15

Rated as the world's finest high-production electrode. Working range extends from light gauge to heavy plate. High heat and speeds can be used without risk of undercut. Operates with a quiet, even, smooth arc of medium penetration.

SW-44

A self-cleaning iron powder electrode. Ideal for all jobs in AWS Class E-6012, this weld-rod lets you deposit far more weld metal than conventional electrodes in its class. Easy re-striking — even when rod is cold.

chooses A. O. Smith electrodes for

all manual welds

A. O. Smith SW-15 and SW-44 weld-rods used for production welding of Cleaver-Brooks new "packaged" boilers

WHEN Cleaver-Brooks started production of its new, streamlined CB boilers, they selected A. O. Smith electrodes to obtain excellent welds that could meet production economies without sacrificing quality. Welds must, of course, be perfect to withstand 1½ times their design pressures, and actually they test out far in excess of ASME code requirements.

These new boilers are the result of nearly 25 years of design and manufacturing experience. Only the finest materials are used. That's why Cleaver-Brooks' engineers insisted on the A. O. Smith SW-15 electrode that produces an easily-controlled, forceful arc with deep penetration in all positions. They also specified the SW-44 iron powder electrode that's so easy to use and produces excellent beads — flawlessly smooth and practically self-cleaning.

If your products demand quality welds every time, it will pay you to buy A. O. Smith electrodes. Call your A. O. Smith distributor today, or write A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wisconsin.

The man from A. O. Smith

Roy Norton is the A. O. Smith Distributor who services the Cleaver-Brooks account. He's not only a salesman, but a welding specialist who is glad to help you with your welding problems.

PRODUCED BY WELDERS FOR WELDERS

Because welding is our full-time business, we offer you America's finest welder-proved electrodes, machines and accessories.

Through research ...*a better way*

A.O.Smith

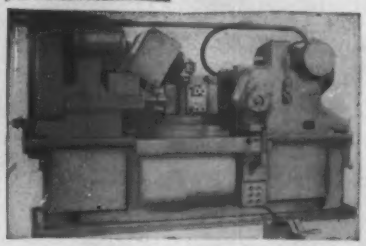
CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore, it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

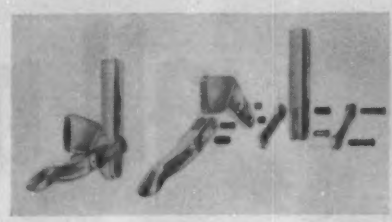
Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

GOSS & DELEEUW
QUALITY · PRODUCT · QUANTITY

GOSS and DELEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

to offer longer life, smoother cuts, less breakage. Available in all standard 3-, 4-, and 6-tooth sizes.

Atkins Saw Div, Borg-Warner Corp, Indianapolis, Ind



Toggle Clamps Have Replaceable Parts

Two Titan toggle clamps, weighing 4½ lb, with holding pressures up to 4000 lb, have replaceable parts and forged alloy-steel components. Threaded pivot rods and serrated bushings are used throughout.

Model 557, shown, has a low silhouette, for use where overhead clearance is limited. For production jobs where clearance allows use of an upright handle, Model 558 is recommended.

Detroit Stamping Co, 343 Midland Ave, Detroit 3, Mich

Raytheon Electronic Duplicator Designed for Lathes to 16 in.

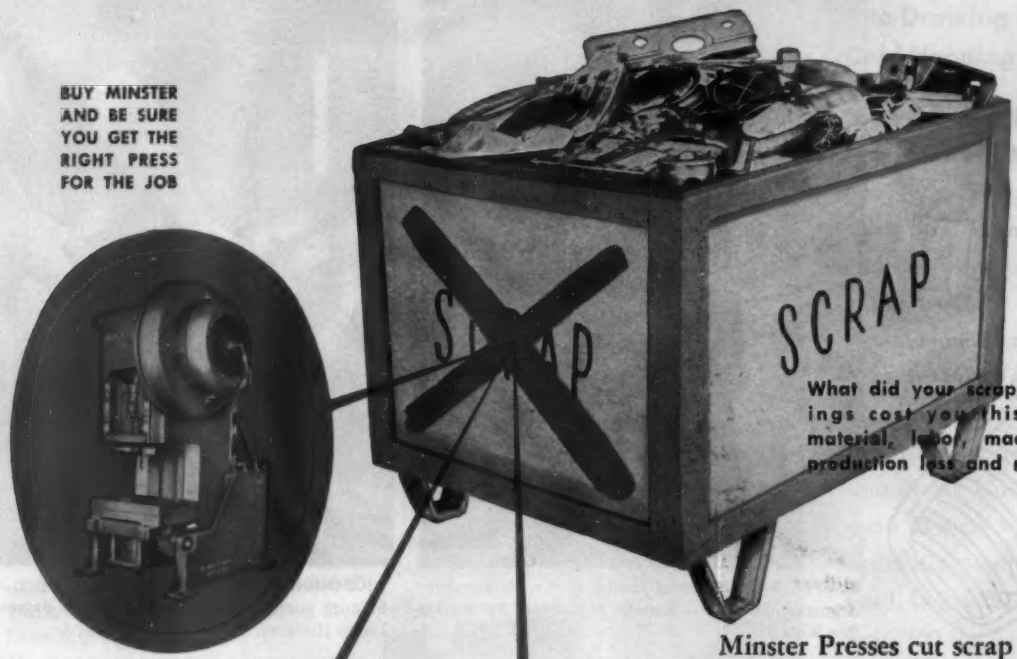
Model 2-422 electronic duplicator is single-motion type designed for lathes to 16 in. in capacity. Unit is said to be accurate to ± 0.0015 in., with stylus pressure of 8 oz.

Duplicator may be attached or removed from lathe, and does not in-

A Minster Press means

LESS SCRAP

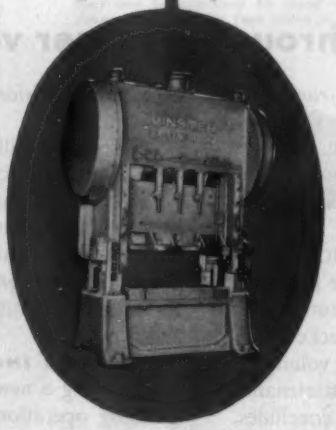
BUY MINSTER AND BE SURE YOU GET THE RIGHT PRESS FOR THE JOB



What did your scrapped stampings cost you this week in material, labor, machine time, production loss and rehandling?

Minster
Series 1 O.B.I. Presses

Minster
Series S-1 Presses



Minster
Series S-2 Presses

Minster Presses cut scrap loss, save you money because they provide:

1. Greater frame rigidity, with less deflection.
2. Extra long ways and gibs, widely spaced and precision finished, assure slide and bed parallelism.
3. Fast action, controlled cycling with Minster's patented Air Operated Combination Friction Clutch and Brake.
4. Minster Controls combine with fast clutch action to help reduce scrap caused by misfeeding.

Build a sound replacement program modernize with Minster Presses

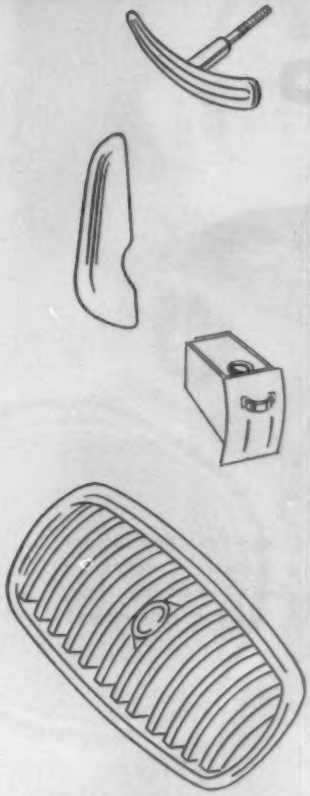
THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

PRESSES

Another field report on "TRICLENE" D



BUMPER GUARDS being loaded into roller conveyor degreaser at Grand Rapids Metalcraft by worker Ben Kolenda.

THOROUGHLY CLEANED with TRICLENE D, bright bumper guards are removed at end of degreaser by James Holliday.

"TRICLENE® D makes vapor degreasing easier than ever . . . now we can put through a larger volume of work,"

Says C. Nesselroad, Mgr., Grand Rapids Metalcraft, Division F. L. Jacobs Co., Grand Rapids, Mich.

"We operate six degreasers—two manual and four conveyorized," continues Mr. Nesselroad, "and since we turn out as many as 150,000 parts per day, we've found we just can't *afford* to have trouble."

That's why Grand Rapids Metalcraft uses TRICLENE D trichlorethylene. With this rugged solvent, they've had consistently thorough, trouble-free degreasing of the automotive stampings they manufacture—bumper guards, brackets, ash trays and grill parts. And with TRICLENE D, their volume of work handled has shown an *increase* . . . and maintenance costs have *decreased*. Furthermore, Mr. Nesselroad concludes, "We've never found a degreasing job that TRICLENE D trichlorethylene couldn't do!"

Locked-in stabilizers give TRICLENE D unsurpassed resistance to *all* major causes of solvent deterioration—heat, light, air, acids and aluminum chloride—yet this rugged solvent contains nothing to harm even delicately machined metal surfaces. TRICLENE D retains its original high purity longer . . . continues to give *brighter cleaning of any metal* job after job, distillation after distillation. And remember, it costs no more!

FOR MORE INFORMATION on TRICLENE D and how it can bring a new standard of efficiency to your vapor degreasing operation, write our nearest District Office. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

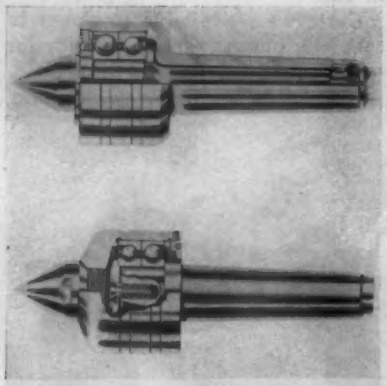
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

TRICLENE® D

TRICHLORETHYLENE

terfere with normal use of lathe when desired for non-contouring work. Device is electronically controlled, with no hydraulic mechanism.

Raytheon Manufacturing Co, Waltham 54, Mass

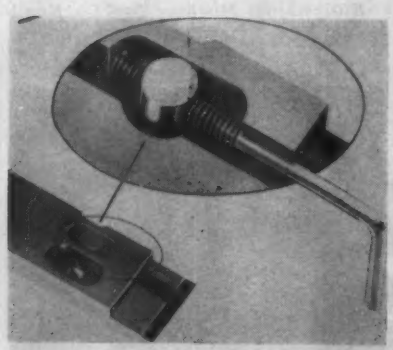


Grinding Centers Have Radial, Thrust Bearings

Red-E antifriction centers for cylindrical grinding are available in shank and spindle types. Bearing assemblies consist of two matched, preloaded bearings: large ball of 35° angular contact for maximum thrust support; small ball of 15° angular contact for greater radial support. Manufacturer reports that thrust and radial supports hold runout to less than 0.00005 in. TIR.

Both shank and spindle types are available in wide variety of standard tapers. Special heads, tapers, shanks and points can be ordered.

Ready Tool Co, 554 Iranistan Ave, Bridgeport, Conn

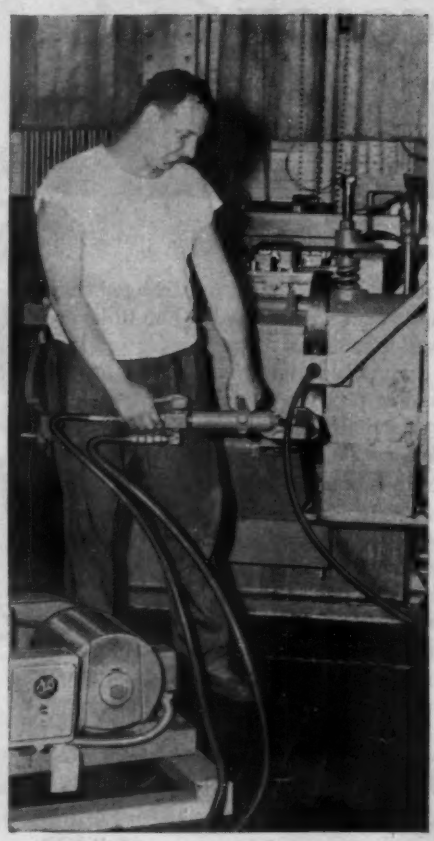


Cutters Have Protected Adjustment Screw

Protected cutter adjustment on Maxwell boring and reaming cutters reportedly improves performance and increases tool life. The micrometer adjusting screw, which is recessed for protection against chips, can be

MANCO GUILLOTINE

Hydraulic Rod Straightener



Fast, easy to use, the Manco Rod Straightener can be operated by hand valve as shown above or by foot valve if desired.

Straightens Ends of Coiled Rod For Insertion Into Drawing Dies or Cold Heading Machines

With the new Manco Guillotine Hydraulic Rod Straightener you can quickly and easily straighten the leading end of heavy coiled rod. It takes only 15 seconds to straighten a four foot length. Capacity for 9/16" to 1¼" diameter rod. Powerful hydraulic action develops 10 tons thrust. Unit is equipped with Manco 3 h.p. electric hydraulic pump. Weight of head, 18 lbs. Weight of pump unit, 300 lbs.

NEW MANCO GUILLOTINE CATALOG
also available on complete line of special hydraulic tools for cutting, shearing, punching, bending, riveting.

WRITE FOR COMPLETE INFORMATION

AM-11D

Manco Mfg. Co., Bradley, Illinois
Please Send Me:

☐ Bulletin on Rod Straightener
☐ New Manco Guillotine Catalog

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Firm Name.....
Street.....
City..... State.....

an ACCO product

ACCO's Great New Chain...

ACCOLOY X-WELD 125

• *At last*—a chain with welds as strong or stronger than the material . . . welds that won't break when links are bent sharply . . . welds made with two projecting lugs that absolutely prevent dangerous kinking of the chain . . . welds that provide 2¼ times the welded area found in normal flash or butt-welded links. **Accoloy X-Weld 125** Chains hang straight as a die. Every link is perfectly formed!

Accoloy X-Weld 125 Chain has almost countless uses: Slings, bundling, towing, general utility chains . . . It can be furnished in special analyses and heat treatments to provide greatly extended life and use on **tough jobs** . . . corrosive jobs . . . abrasive jobs . . . hot jobs. Specify **Accoloy X-Weld 125** for your next chain job for a new concept of chain performance, economy and value. Available in ¼", ⅜", ½", ⅝" and ¾" sizes.

• *Ask our nearest district office for further information on* ACCOLOY X-WELD 125 CHAIN, *or write the American Chain Division, York, Pa., for descriptive bulletin.*

PATENT APPLIED FOR

The Secret is in the Weld!

This Accoloy X-Weld 125 link was ground and etched to show its big welded area —2¼ times the size of welded area possible with other welding processes. This means more than double the security at the weld—and only X-Weld has it!

ACCO

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American Chain Division
AMERICAN CHAIN & CABLE

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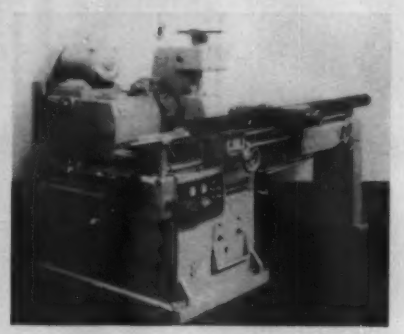
for Better Value

adjusted in both directions to increase or decrease cutter diameter.

For reaming operations the cutters employ selective float control. Cutter floats in bar at point of cutting action, and float can be adjusted between bar and cutter to compensate for misalignment of equipment. In boring operations, cutter is locked in bar.

Cutters are available singly or in sets. 16 cutters are required for bores between 1 in. and 2 in. dia.

Maxwell Co, 386 Broadway, Bedford, Ohio

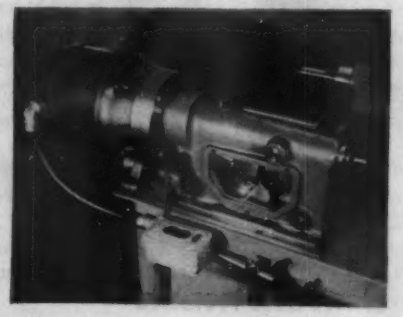


German Cold-Sawer Takes 4⅜-in. Round Stock

Semi-automatic, single-lever control cold-sawing machine, Model WK-360, is manufactured by the Gustave Wagner Machine Tool Works of Reutlingen, Germany. Machine has a capacity of 4⅜-in. rounds, or other shapes in proportion.

Same basic machine is also offered as Model WKA-360 full automatic; WKM-360 semi-automatic high speed for sawing common non-ferrous metals; and as WKMA-360 full-automatic high speed for common non-ferrous metals.

Klingelhofer Machine Tool Co, Kenilworth, NJ



Zagar Feed Units Are Cam-Controlled

Line of cam-controlled feed units is available in four sizes up to 5-hp capacity. Designed for drilling, ream-

(Continued on page 232)

there's a NEW one to look at . . .

Whether you're an old timer or relatively new in machine shop matters, don't overlook Axelson if you're thinking about a milling machine.

Probably you know about Axelson lathes. We've been building them for over 40 years, and have earned a proud reputation with them. Now we offer a milling machine engineered and built to the same high standards of strength and precision.

If you're in the market for a milling machine, it will pay you to look at Axelson. We'll be happy to send descriptive bulletins that tell the whole story. Just ask us.

AXELSON

AXELSON

MILLING MACHINES

make man hours mean more

Producers of the World famous Axelson Lathe

AXELSON MANUFACTURING COMPANY

DIVISION OF U. S. INDUSTRIES, INC.

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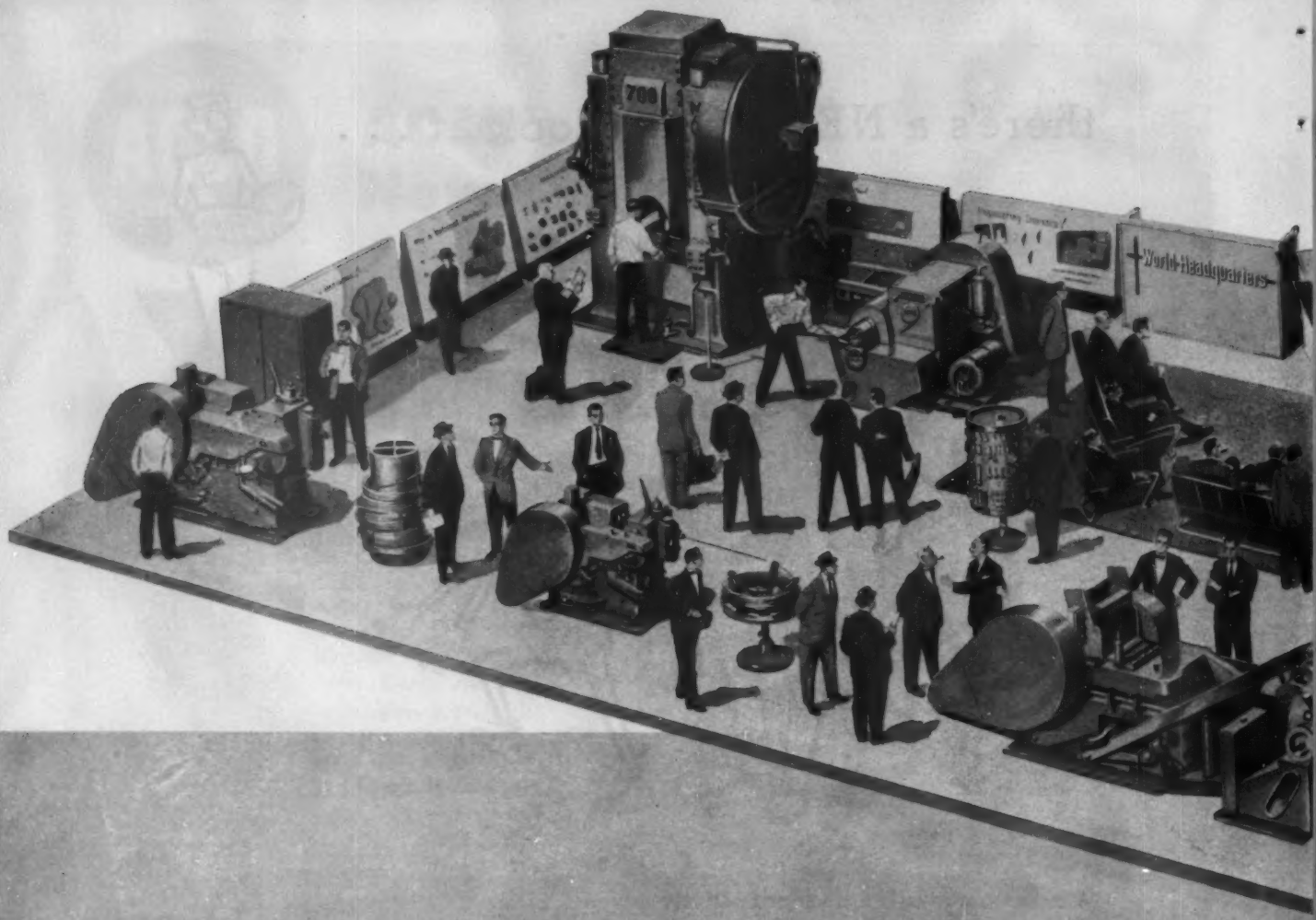


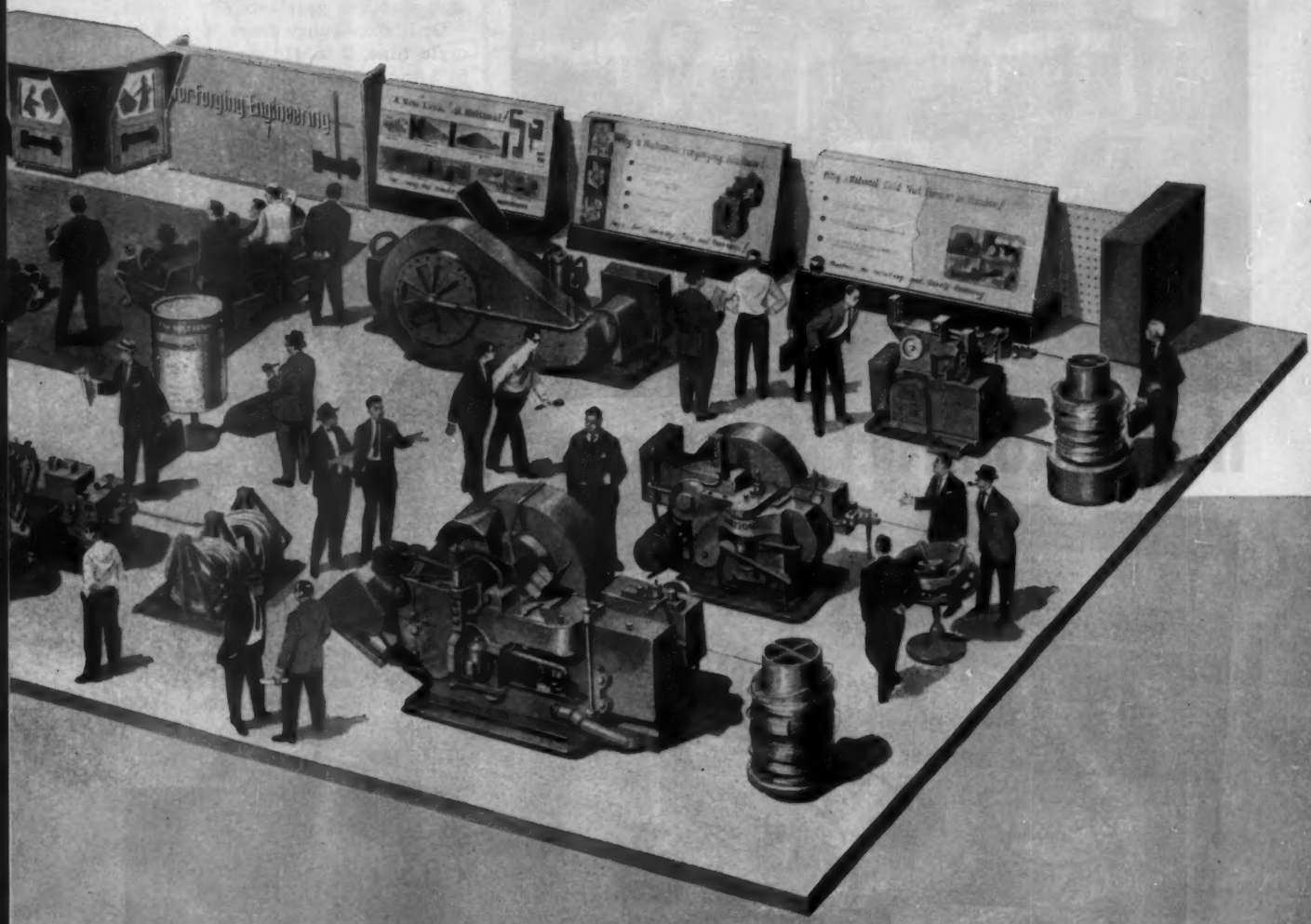
Working with You in Forging Is Our Year-Around Job!

We sincerely thank the metalworking industry for its interest in our exhibit at the Machine Tool Show in Chicago (illustration above).

More helpful to industry, however, than this exhibit of forging equipment, is National's own "show" which is going on constantly at the plant in Tiffin, Ohio.

Our entire organization and our years of experience are here to help you "flow metal"—hot or cold, automatically or manually, routine or unusual.

We would like to welcome you at our "World Headquarters for Forging Engineering"—where tomorrow's better ways of producing metal parts are already being tested today.



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DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

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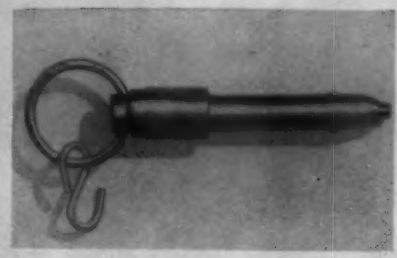
ing, tapping, and milling operations, each unit is self-contained, deriving power through single motor with no air or hydraulic involvements.

Standard equipment includes four standard-purpose cams and set of cycle change gears. Four drives are available: cone pulley, direct motor, stub-shaft, or gear box.

Drill sizes range from ⅜ to 2 in.; cycle time, 2 to 410 sec; stroke, 2⅜ to 5 in.; spindle speeds, 200 to 4032 rpm.

Zagar Tool, Inc 24000 Lakeland Blvd, Cleveland 23, Ohio



PIP Pins In New Model

Model B double-acting, self-safetying PIP pins now incorporate spindle lock extended beyond tip and continuous pull rings to replace comperssion springs on older models. Available in T, L, and button-type head styles, pin is useful as part of bracket, clevis, or as tube joiner.

Aviation Developments, Inc, 210 S Victory Blvd, Burbank, Calif

Larger Size Grind-O-Flex Wheels

Two 10 and 12-in.-dia wheels in 1 or 2-in. widths are available in a full range of grits (from No. 40 to 320) for smoothing off flash to high polish operations. Several wheels may be ganged on one spindle to cover a broad surface, each wheel flexing individually to follow contours.

Light in weight, units may be used on light equipment or in automatic

(Continued on page 237)

KEMPSMITH MASTER-MILL

It's **NEW**
It's **MODERN**

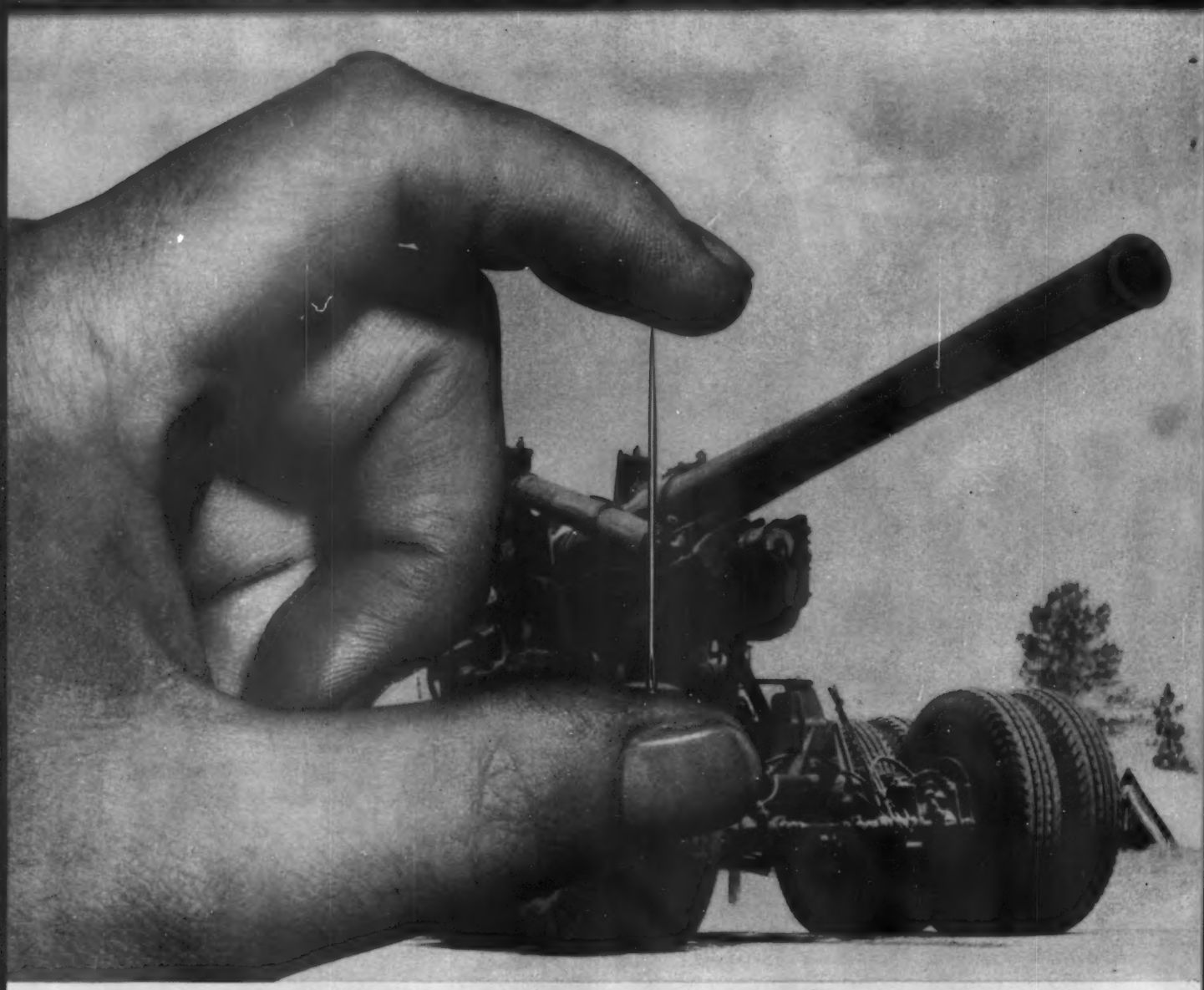
The Hit of the Show at Chicago!

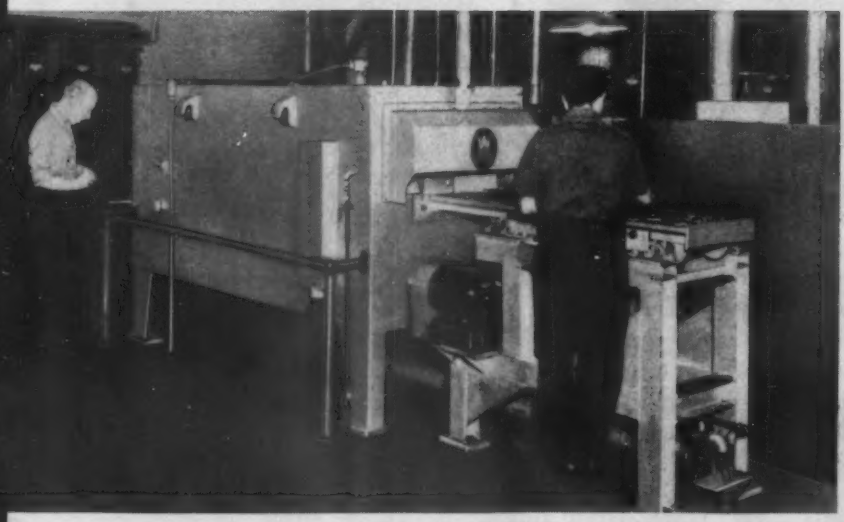
The enthusiastic reception accorded the new Kempsmith MASTER-MILL at the Machine Tool Show is now history. Thousands of production-minded visitors witnessed the demonstration of this modern milling machine. They agreed, the Kempsmith MASTER-MILL is the finest, most efficient, most productive milling machine of its size and horsepower on the market today, regardless of price. It cuts milling costs to rock bottom by fully utilizing modern cutting tools and techniques. Conveniently located controls permit more rapid set-ups, thereby providing more cutting time. Low initial cost, plus economy of operation, assure highest return on investment. Now available in sizes No. 2 and No. 3—Plain and Universal models. For descriptive literature on these modern milling machines write:

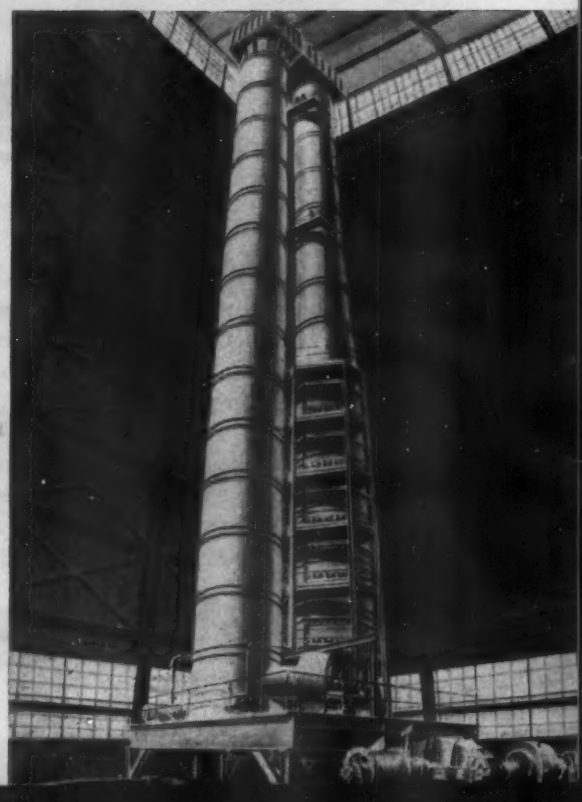
KEMPSMITH MACHINE CO., 1823 So. 71st St. Milwaukee 14, Wis., U.S.A.

Precision-Built MILLING MACHINES Since 1888!

A 8501-1PC







FROM BOX TYPE TO ELEVATOR TYPE . . . this wide range of Westinghouse furnaces offers industry heat-treating units specially engineered for the smallest toolroom jobs on up to furnace capacities for massive parts treating. Accurate temperature control, uniform temperature distribution and low heat loss in Westinghouse furnaces assure high and constant quality level.

Needles to cannon barrels . . .

heat-treat them in Westinghouse furnaces

Across the board in heat-treating, for small jobs or mass production, Westinghouse makes the exact furnace needed. From manually operated box type to complex automatic conveyor units, Westinghouse furnaces assure the maximum in speed, quality and economy.

This complete line includes furnaces using either gas or electric heat source . . . atmosphere generators providing all gas variations required . . . and auxiliary equipment to speed and simplify work handling.

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Westinghouse offers a unique and comprehensive service that extends ideas, know-how and capacity to solve heat-treating problems. At any stage of planning or production, Westinghouse engineers can be called to your plant for sound, unbiased recommendations that will help you get more from heat-treating operations. Skilled designers, packaged installation techniques (even to complete erection and installation where needed) and maintenance follow-through, combine with this engineering staff to form a dependable service that is unmatched in the heat-treating field.

Use coupon below for your free 40-page book on the complete line of Westinghouse furnaces and equipment. For further information write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-10433

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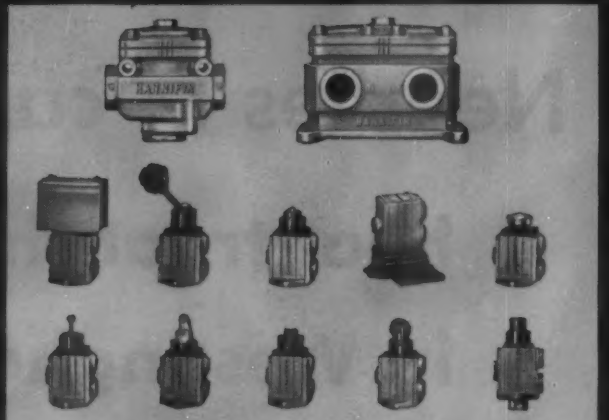
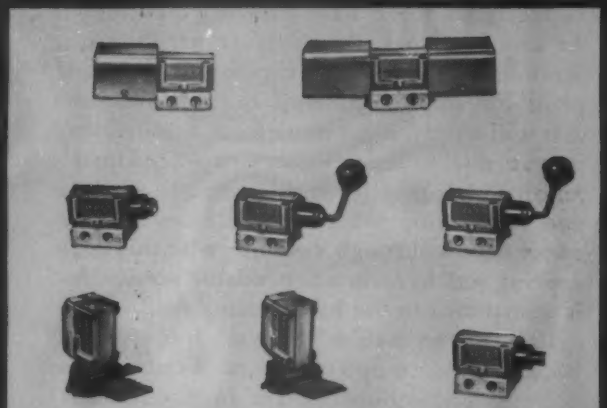
FOR AIR CYLINDER CONTROL... Manual or Electric

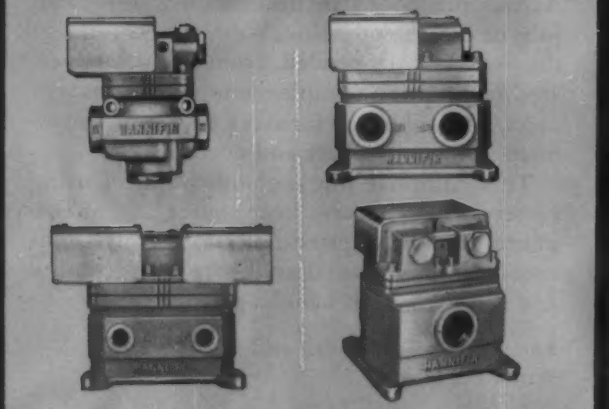
Hannifin Disc Valves. 3-way and 4-way, direct- or pilot-operated. For hand, foot or electric actuation.



Hannifin P-M Master Valves. 2-way, 3-way, 4-way. Remotely controlled from wide choice of Pilot Valves.



Hannifin P-M Direct-Operated 4-Way Valves. Small, compact, inexpensive. For every type operation.



Hannifin P-M Pilot-Master Valves. Solenoid controlled by integral pilot heads. 2-way, 3-way and 4-way.

HANNIFIN has the Air Control Valves for Your Specific Applications

Hannifin has the air control valves you need for use on your production lines or on the products you manufacture, often in a choice of types.

Shown here are typical valves from the extensive and complete Hannifin line. There's a Hannifin valve for every use from the simplest to the most complicated air-operated circuit. Singly or in combination, Hannifin valves provide hand, foot, cam, pressure or solenoid operation . . . in almost every pipe size.

You can simplify your air control valve problems by standardizing on Hannifin. Call in your Hannifin representative, who will discuss your valve requirements. Meanwhile, write for our complete Control Valves catalog.

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Your copy of the complete Hannifin Control Valves catalog will be sent on request.

Stock Delivery on all types!

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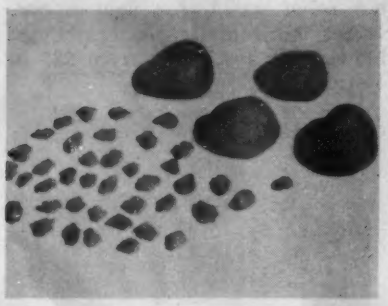
Hannifin Corporation, 517 S. Wolf Road, Des Plaines, Ill.

Air and Hydraulic Cylinders • Pneumatic and Hydraulic Presses • Riveters • Air Control Valves

setups. Wheels are provided with flanges to fit any threaded spindle; may be quickly mounted on grinders, buffers, motor shafts, polishing jacks, or automatics.

Merit Products, 4623 Irving Place, Culver City, Calif



All-Purpose Tumbling Chip

Lorco fused aluminum-oxide chip, said to be the fastest and hardest cutting abrasive known for precision barrel finishing, can also be used for coloring and burnishing. After treatment with Lorco compounds, the chip will burnish as well as, or better than steel balls, according to the manufacturer.

Chips are screened to range downward in sizes from 00 (2 in. to 1½ in.) to No. 16 and finer.

Lord Chemical Corp, 2068 S Queen St, York, Penna

Batch Oven Control Modulates Wattage

Blue M industrial batch ovens have as standard equipment a control system which automatically proportions wattage in direct relation to operating temperature and work load, reportedly resulting in straight line control throughout oven range. Operator sets only temperature; when temperature is reached, control automatically modulates minimum wattage for operation. If door is opened, heater elements are ener-

GROUND FLAT TOOL STEEL

Save time and labor with Microloy, Capewell's non-deforming, oil-hardening tool and die steel that combines a tough cutting edge with extremely close retention to size after hardening and tempering. It is ideal for tools and dies where construction does not permit grinding to shape after heat treatment. Because of its superfine surface finish (10 to 25 micro-inches), Microloy is excellent for template work and for many tools where exact size and shape *must* be maintained.

CHECK THESE OTHER COST-CUTTING CAPEWELL PRODUCTS

Power Hack Saw Blades
Band Saw Blades
Hand Hack Saw Blades
Machinists' Hammers
Wrenches
Pipe Tools

6 big features...

- Deep, uniform hardening.
- Precision-ground to close tolerances.
- Uniformly annealed for easy machining.
- Guaranteed free from decarburization.
- Available in wide range of sizes.
- Exceptionally smooth surface finish.

Always Consult Your Distributor

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THE CAPEWELL MANUFACTURING COMPANY
65 Governor St., Hartford 2, Conn. 11CA89

MACHINABILITY INDEX 80-90*

PEARLITIC MALLEABLE CASTINGS

*B1112 STEEL = 100

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product.

AA-1866

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

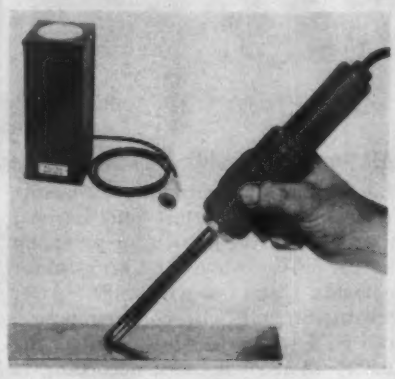
Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

gized to effect temperature stabilization.

Ovens are manufactured in 5 sizes with capacities from 16 to 96 cu ft. Temperatures range from 100°F to 600°F. Triple side walls are constructed of heavy gage steel with 4 in. of fiberglas insulation and blow-out relief panel. Air flow is convected horizontally by centrifugal blower run by V-belt from 220 or 440 v motor.

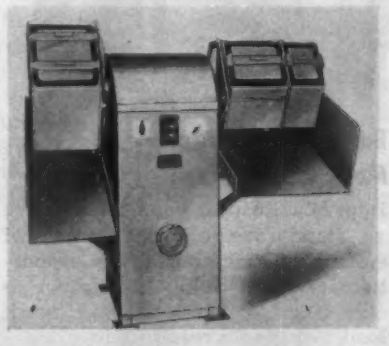
Blue M Electric Co, 138th & Chatham St, Blue Island, Ill



Ultrasonic Soldering Gun Has Internally Heated Tip

Alcar Model 1152 solder gun with internally heated tip is designed for fluxless soldering and tinning of aluminum, germanium, silicon, and similar metals. Special heating coil within the transducer delivers heat to the working tip via a second power line contained in the cord set. Unit is resonant at 20 kc, and may be operated from either 30 or 100-watt Alcar generators. Price, $125.00.

Alcar Instruments, Inc, 17 Industrial Ave, Little Ferry, NJ



Rampe Tumbler Handles 3 Loads at Once

Rampe Super Twin barrel finisher has three different-size barrels fitted

(Continued on page 242)

R B & W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Selecting the right grade of bolt

With few exceptions, the true function of a bolt is to clamp members together, and not to act as an axle or fulcrum. The residual tension set up in the bolt keeps joints tight.

There's rarely need for costly alloy steel fasteners—not when 3 physical grades of steel can satisfy most "clamping" applications.

SAE grade 1 offers 55,000 psi minimum tensile strength; grade 2, 68,000 psi; and grade 5, approx. 120,000 psi.

The first is used for fasteners which are stress-relief annealed to increase ductility. The next provides low carbon fasteners with a bright finish. The last goes into high-carbon, heat treated black fasteners identifiable by three radial dashes on the head.

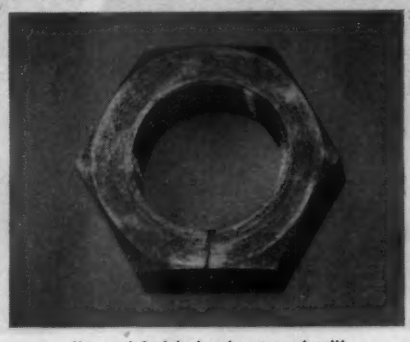
SOME SUGGESTIONS

In terms of holding power, the stronger bolts and cap screws can cost you less than the cheaper bright ones. For example, either a ⅝" with three radial dashes or a ¾" bright cap screw can be used for a safe working load of 20,000 pounds. But being smaller, the high strength one costs less. However, if the same diameter is desirable, then fewer bolt holes need be made and faster assembly achieved when a product is designed to make use of high strength bolts.

In short, for more pounds of clamping effort per dollar, use high strength fasteners; for more pieces per dollar, use the lesser grades.

Cold Punched Nuts add to safety factor

NUTS dilate when tightened on a bolt. They also adjust plastically to distribute the load over many threads. Since nuts are overdesigned to be stronger than the bolt, these stresses can be disregarded for all practical purposes.



How a defect in hex bar caused split in nut machined from it.

Drift punch had to distort cold punched nut severely, far beyond its yield point before it cracked.

There are times, however, when nuts with optimum assurance against service failure are desired. In such cases, it pays to consider use of RB&W cold punched nuts.

These nuts are punched at right angles to the metal's flow lines . . . same direction as stress encountered in service. No unrelieved stresses are set up. The initial punching automatically reveals any defects. Repunching, an RB&W development, then not only trues up the hole for clean, concentric threads, but also serves as a drift punch test, automatically checking the soundness of these safest of nuts.

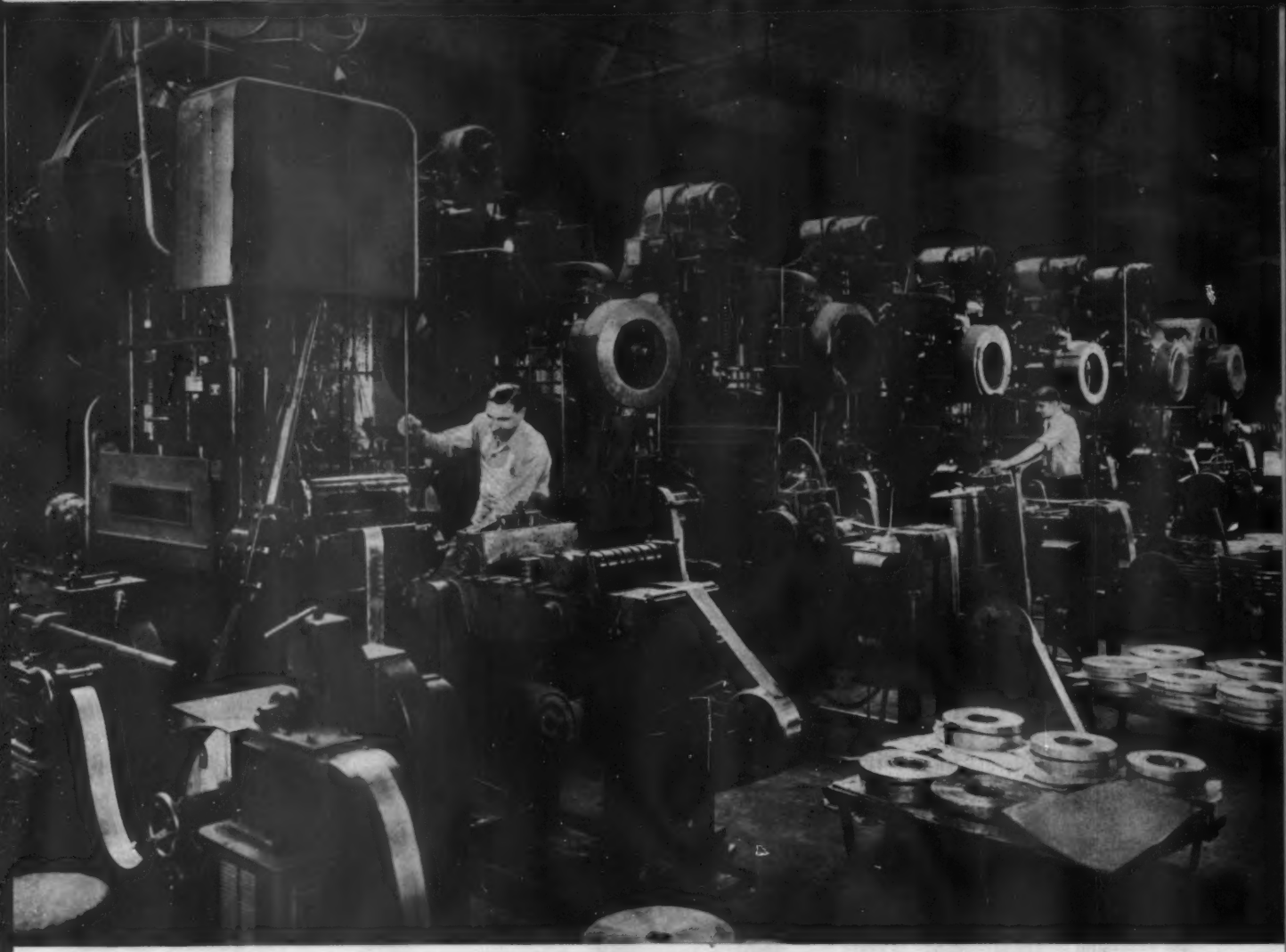
For help in applying standard fasteners to assure more assembly strength and less assembly time, feel free to call in an RB&W man. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore, (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

One-piece fastener better than two

One particular oil filter used to be fastened with stud and cap sleeve made by screw machine. This was only until RB&W pointed out that a one-piece fastener could be formed easily on a cold header. The advantages gained are obvious. The single fastener *cost* less, and took *less time* to assemble.

RB&W makes a tremendous variety of strong, uniform standard fasteners to improve assembled metal products. If any of these don't fill a particular need, perhaps an RB&W "special" can be developed that will.



Every metalworking company is in business to manufacture products they can sell successfully . . . and the first and biggest order of business is to keep Production supplied with everything it needs.

At the Modine Manufacturing Company, for example, 78.89% of every purchase dollar is invested in the machinery, equipment, materials, and supplies used by Production.

ive

. . . the production way

The McGraw-Hill Magazine of Metalworking Production,

Published every other Monday

Famed as manufacturers of heating, air conditioning, specialized heat transfer equipment and automotive radiators, the Modine Manufacturing Company of Racine, Wisconsin, must have the finest metalworking equipment. This policy has made Modine an acknowledged leader for quality and craftsmanship in its field. Here a battery of high-speed presses, reel-fed, turn out thousands of parts for Modine products.

"78.89% of purchases for PRODUCTION"

No wonder, then, that Production's engineers and executives have Metalworking's *most important buying voice.*

No wonder, either, that *American Machinist* is the most powerful advertising force in America's biggest industry. It is edited exclusively for Metalworking Production . . . gives Metalworking Production the most help . . . attracts more production-responsible subscribers than any other metalworking magazine . . . sells Metalworking Production with unmatched impact and long-sustained results.

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PRODUCTION COST

Cut 2/3

You Can Make a Similar Saving in Your Assembly Department!

DPS POWER SCREWDRIVERS assembling automobile arm rests

● These two machines maintain a production rate in excess of that previously attained by six hand operations, effecting an immediate saving of 66⅔%. This versatile equipment, used in prominent plants everywhere, can be adapted to your individual needs—So, get more action in your Assembly Department now—more speed—more profit. Write us, give details and our trained engineers will work out the proper solution of your problem.

DETROIT POWER SCREWDRIVER CO.

2821-A W. FORT ST. DETROIT 16, MICH.

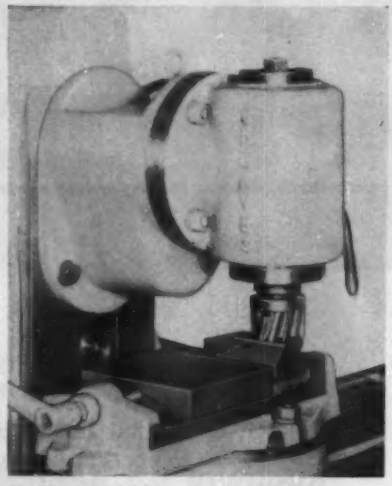
to basic unit: 2 cu ft barrel, 10¾x23 in.; 1.1 cu ft barrel, 10¾x17 in.; and 5 gal. barrel, 6¾x17 in. Two smaller barrels on one side of unit are balanced by 2 cu ft barrel on other.

Specifications include ¾-hp, 220/440V, 3-phase motor; variable-speed drive from 12 to 36 rpm; pushbutton switch and magnetic starter.

Movable chutes tilt forward to aid in draining off liquids and materials separately, backward to form safety guard.

Rampe Manufacturing Co, 14915 Woodworth Ave, Cleveland 10, Ohio

SHEARCUT ROTARY BROACHES are offered with tapered shank, in sizes from ¼ to 1 in. in 1/32-in. increments, and from 1 1/16 in. to 1½ in. in 1/16-in. increments—*Shearcut Tool Co, 7045 Darby Ave, Reseda, Calif*

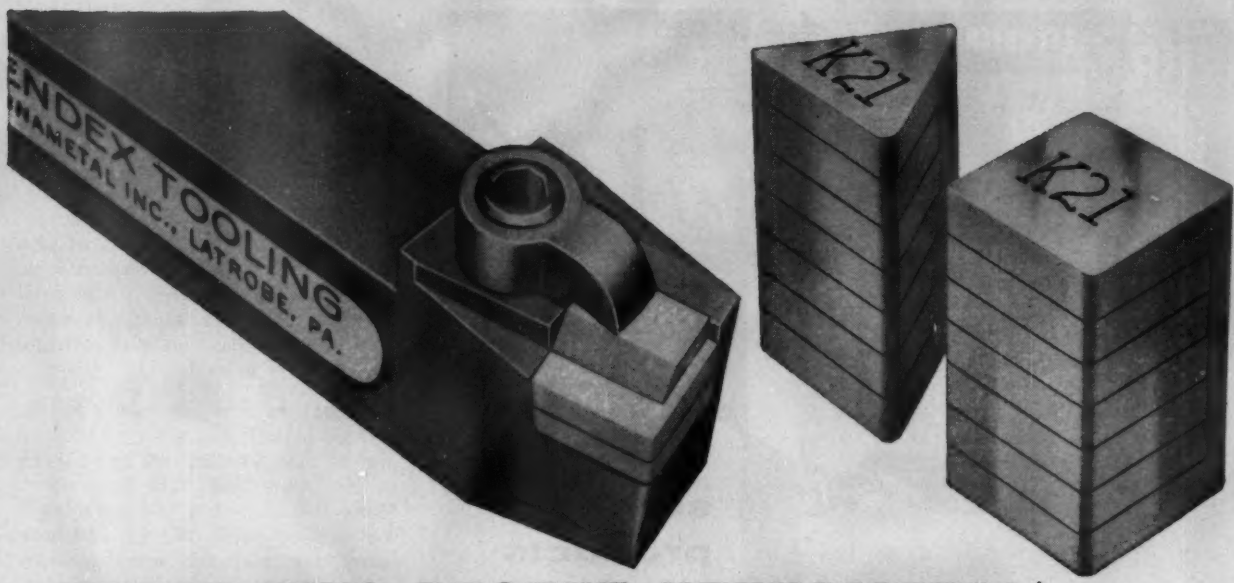


Greaves Milling Attachment Gives 4½-in. Extra Clearance

Offset vertical milling attachment is designed for use with Greaves horizontal milling machine, provides up to 4½-in. additional vertical clearance through use of offset head. Unit drives directly from milling machine spindle. Gearing is provided to permit mounting of vertical spindle higher than point of drive, giving additional capacity between vertical spindle and machine table.

Attachment is equipped with Timken roller bearings for spindle mounting, and provides speeds at 1:1 ratio with spindle speeds of horizontal mill. Head of attachment may be swiveled through 360° to provide angular positioning.

Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio



THESE TWO RECENT KENNAMETAL* DEVELOPMENTS HELP TO MEET TODAY'S HIGH-SPEED PRODUCTION NEEDS

The profit advantages of today's high-speed automatic cycling machines for metal cutting are lost when tools wear rapidly—need frequent regrinding—or are cumbersome to index.

Kennametal recently introduced two new developments to help give you continuous machine performance, and to help step up profits in your steel-cutting operations. These developments are Kendex*† Button Tooling and Kennametal Grade K21.

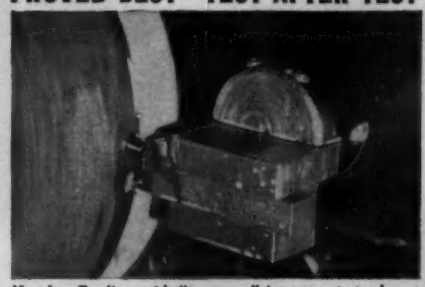
Kendex "turnover" inserts, with replaceable Kennametal shims and new chip control system, double the number of cutting edges, eliminate all regrinding and index in seconds. These features help provide consistent tool performance and hold downtime to a minimum.

Grade K21 is the General Purpose steel-cutting carbide now outperforming all other medium grades in the carbide industry. Superior performance of K21 is due to exceptionally high edge strength, strong resistance to cratering and superior wear qualities. An extremely versatile grade, K21 can be applied to general steel-cutting, heavy roughing and finishing.

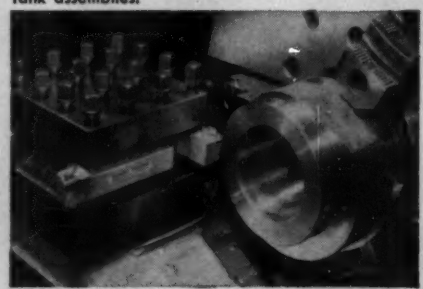
Kendex, in 17 styles and sizes; and K21, in popular blanks and inserts, are immediately available from stock. For their right application on your machining jobs, call a Kennametal Tool Engineer. He works exclusively with Kennametal . . . applying and servicing it. And be sure to ask for reports of Kendex and K21 repeat performances, job after job. KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark †Patent applied for 9403

PROVED BEST—TEST AFTER TEST



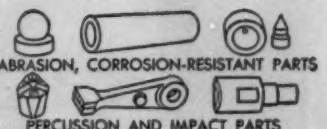
Kendex Tooling with "turnover" inserts cuts tool cost from $1.20 to $0.09 per piece, turning SAE 4140 tank assemblies.



Grade K21—on interrupted cutting, roughed and finished 6 times as many pieces as other premium carbide.

Give your machines the tools they deserve . . . the BEST

INDUSTRY AND **KENNAMETAL** *...Partners in Progress*



ROUND TABLE Discussion

AUTOMATION BLUES

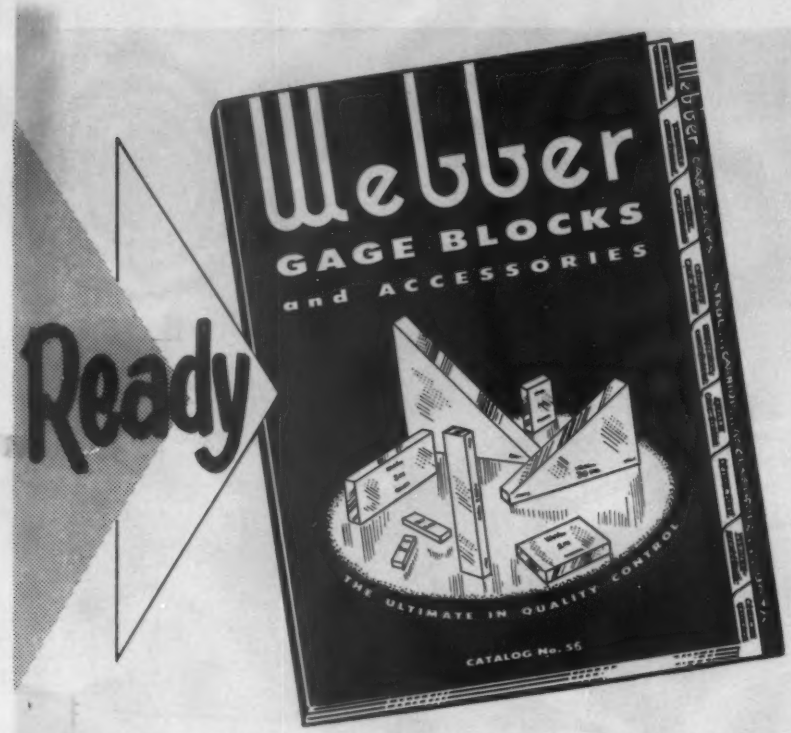
Is automation actually a threat to a worker's job security? Should it be looked on as a system which will eventually replace today's worker, or as a technique that will multiply jobs in other fields?

AUTOMATION is a new name for an age-old idea. It has always been the aim of man to turn out more work in less time and with less effort. Many feel that it is the work itself which is desirable. We see and hear many examples and manifestations of this erroneous short-sighted idea. There are many who feel that it is beneficial to have property destroyed by fire and floods. It is their contention that this makes work for people. It is this same faulty reasoning that sees evil and harm to the race in automation. This error is a basic one. The truth of the matter is that it is not the work itself which is desirable, but the product of the work. It is a basic truth that man desires to produce with the least amount of effort.

Man has always been trying to find easier and better ways to perform the functions which precede his possession of the finished product. There have been millions of intermediary steps between the stone tools of the caveman and the truly marvelous machines of the present day. Every one of these advances was the result of this same desire; how can any thinking person deny the existence of this force?

Man will grow to accept automation in the same way that he learned to accept the steam engine and the subsequent labor-saving devices of

NEW
Allen leader point cap screws
Dropping, knocking against metal surfaces and faulty line-up are major causes of damaged threads. Allen's new unthreaded leader point substantially reduces the causes of screw thread injury, or damage to threaded holes. Grip Heads, precision fit sockets that adhere to the key, *plus* the new leader points, make Allens the world's easiest starting cap screws, particularly in inaccessible spots. Sold *only* thru leading Industrial Distributors.
ALLEN HEAD
ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut U.S.A.



The NEW Webber Catalog for 1956

• For more than 25 years, precision manufacturers and toolmakers have relied upon Webber for the finest, most economically priced gaging equipment.

The 1956 Webber catalog presents the newest developments in gage blocks and related accessories, and, in our opinion, offers the most complete selection of such equipment available today . . .

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the industrial revolution. The industrial revolution took generations because its growth was limited to the growth and development of the machine tool industry. Its growth was slowed by the necessity of investigation of the primary laws of science. Research and education were necessary and an army of scientists, mechanics and technicians had to be built up.

The growth of automation will be much more rapid than the growth of the machine age. We have the tools and machines to produce the automatic equipment. We have the instruments and controls required. We have closed circuit television to supervise the operations from a control board. We have the technicians and the know-how. From here on it will be a matter of time and education—education of labor and the labor leaders. They must be shown that the advantages of automation revert to them—not just partially, but practically in their entirety.

Look at the picture as a whole. Just what really has happened in the last fifteen years or so? During this period the population of the United States has increased 22%. But the total number of jobs has grown by 35%, or more than half-again as much. In the field of manufacturing itself where automation has advanced most rapidly, employment has gone up 73%, or more than three times as fast as the population. This rapid increase in employment has occurred because of mechanization—not in spite of it. The building of the machines themselves, plus their installation and the maintenance of them together with the construction of factories to house them, has opened up thousands of job opportunities that never existed before.

Finally, of course, our advance in technology has created whole new industries and vast new fields of op-

"Out of cutting oil again, Smelby?"

250 TONS OR 2500 TONS

Large or small . . .
your stampings cost less
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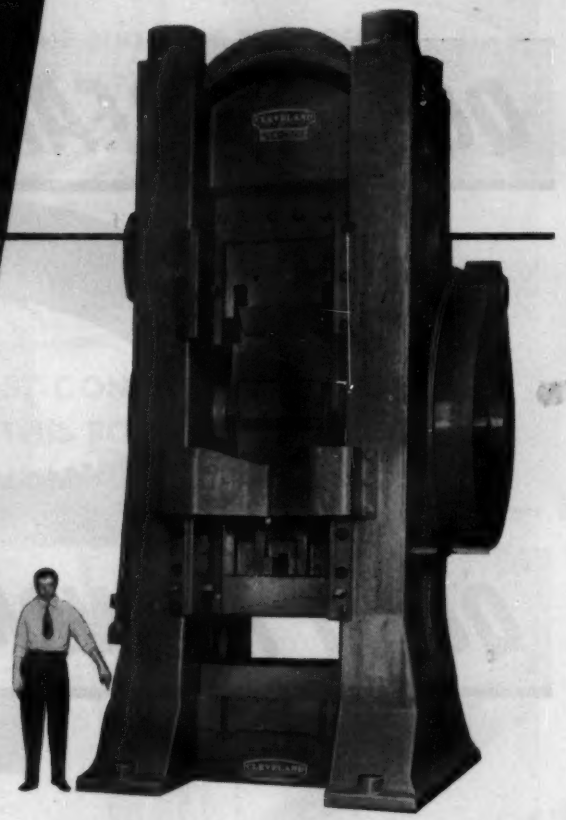
CLEVELAND PRESS!



Cleveland 25K Knuckle Joint Press 2500 tons capacity

Cleveland S1-250-36-42 Straight Sided Single Point Press 250 tons capacity

Each of the 11 specialized types of Cleveland Presses is made in a wide range of sizes. You're sure of getting the exact press to give you utmost production economy.

The construction of all Clevelands is simple and powerful featuring ease of adjustment, minimum wear of moving parts, economy of operation and production accuracy.

You'll find that our patented Cleveland Clutch minimizes costly down-time. It gives you positive, fast control of the slide during all phases of operation. This reduces stamping rejects. What's more its light-weight design requires less horsepower for operation.

Extremely long slide bearing surfaces and rugged frame construction eliminate slide deflection even under maximum load.

These important Cleveland features assure you of lower unit stamping costs. Before you buy your next press won't you let us give you the complete Cleveland story? Just write or call today!

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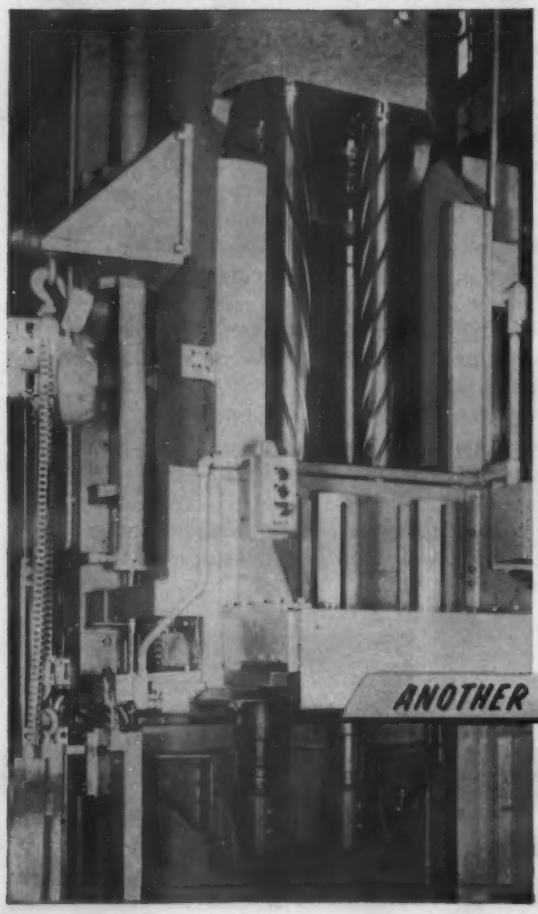
CITY FOUNDRY DIVISION • SMALL TOOL DEPARTMENT

QUALITY GEARS for QUIET TRANSMISSIONS



...broached automatically

Producing quality internal helical gear teeth is the task of two Colonial 2-station RUF-50-72 pull-up broaching machines. All gears are automatically loaded from cartridges and automatically unloaded, with the larger diameter gears being broached two at a time on each station. These quiet transmission gears with three different leads and diameters, have two left hand and one right hand spiral. All three different gears may be broached as production demands on either of the two stations.

Broaches are guided on both ends through full length of cut; broach handling is automatic with safety interlock. Colonial broaches for these gears weigh as much as 800 pounds, and are 81 inches long. Broaches return through a retractable brush and a pressure spray washes chips away. An electric hoist mounted on a universal loading arm handles these broaches in and out of the machine. A cooler for cutting oil, a magnetic chip separator, and an automatic chip conveyor are also furnished on these two Colonial pull-ups.

ANOTHER EXAMPLE OF COLONIAL UNIFIED BROACHING

COLONIAL BROACH & MACHINE CO.
DETROIT 13, MICH.

portunity in television, antibiotics, air-conditioning, new branches of electronics, and now in atomic energy, just to mention a few. So with each passing year, and with each new invention, our people have a wider choice of jobs. Today it is reported that there are more than 40 thousand different ways whereby Americans can earn a living.

Henry George
New York, NY

•

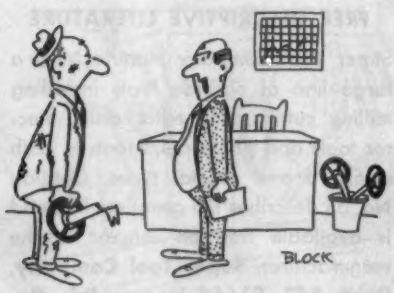
PULL, BROTHERS, PULL

What is the best way to handle the problem of taking on a man in the shop on the supervisor's recommendation that he is a friend of his? Should a foreman refuse if he is dissatisfied with the man's ability?

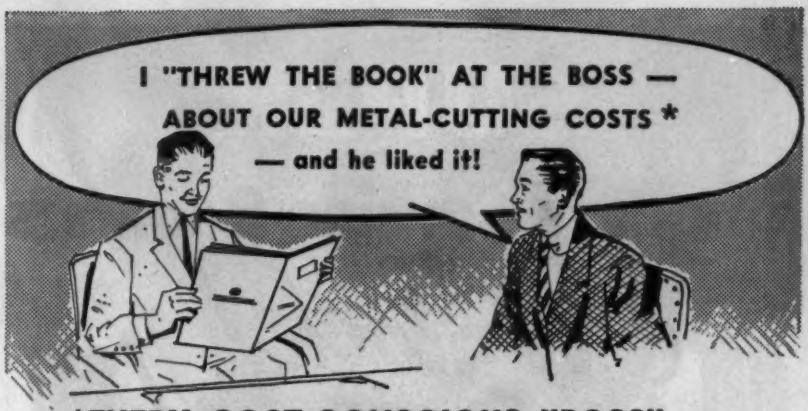
PULL, influence, friendship—call it what you will—is found in all phases of business and social activities. It is a part of human nature, and has always been with us. It plays a significant role in affairs of state, from the highest levels down to the local officials and party leaders. There is no question of how and why it exists. It is a trading medium in politics and operates the same way in the shop. There are many who dislike it, and there are a few who try to fight it. They may succeed in correcting some of the abuses that stem from it, but they can never eliminate it.

In the industrial plant or business establishment, there are those people with friends or relatives seeking employment or advancement. There are those who have repair jobs they want done on company time. In most cases the action taken as a result of these desires is detrimental to the best interest of the company.

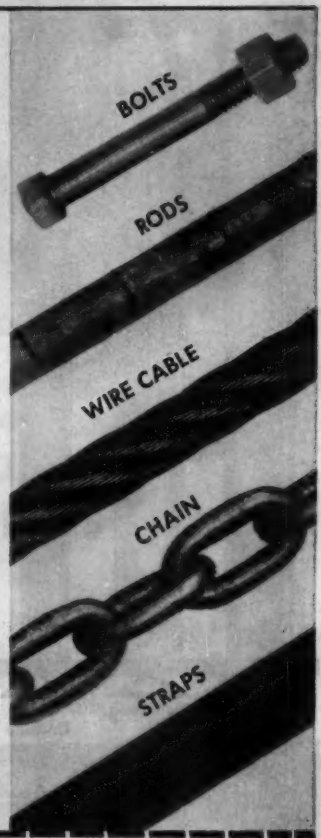
The foreman will take a man on, even though he is unsuited to the job, as a favor to his supervisor. He



"Farnsworth, this is the third morning this week you've been late."



***EVERY COST-CONSCIOUS "BOSS" WILL LIKE THIS BOOK — if his company cuts any of these materials! —**



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This unusual book — "CUTTING METAL the EASY WAY" — is not a PORTER CUTTER catalog. It's a factual study of comparative metal-cutting labor costs — prepared for those "bosses" who eliminate wasted *minutes* to save *hours* — who know that *dollars* saved daily mean *thousands* saved each year. You'll find it profitable reading.

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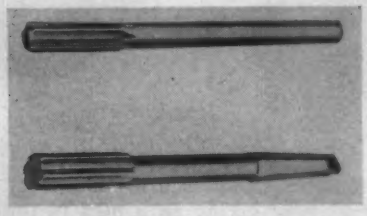


Super Tool Company, Detroit manufacturer of precision carbide tools, has recently announced the availability of a complete line of cost-saving *Semi-Finished Carbide Reamers*, made in a wide variety of sizes and types to accommodate almost any application.

REDUCED TOOL INVENTORY

Mr. Gordon Birgbauer, president, says, "The obvious advantage of *Semi-Finished Carbide Reamers* is reduced tool inventory; you need keep only a limited stock on hand and grind to required diameter when needed. Of course, you also benefit by the lower initial cost of these reamers by doing your own finish-grinding."

.020" GRINDING STOCK

All Super semi-finished reamers are furnished with .020" grinding stock, enabling your tool room to turn out any size within each range in a hurry to meet emergency needs. They are furnished in regular and flute-long types, with either straight or tapered shanks. All sizes are stocked by leading tool and industrial supply houses everywhere.

FREE DESCRIPTIVE LITERATURE

Super Tool Company manufactures a large line of carbide tools including milling cutters, end mills, drills, ejector tools and single point tools in both standard and special types. Catalog No. 55 describes the complete line and is available free on request to the manufacturer. **Super Tool Company, Dept. 343, 21650 Hoover Rd., Detroit 13, Michigan.**

(Advertisement)

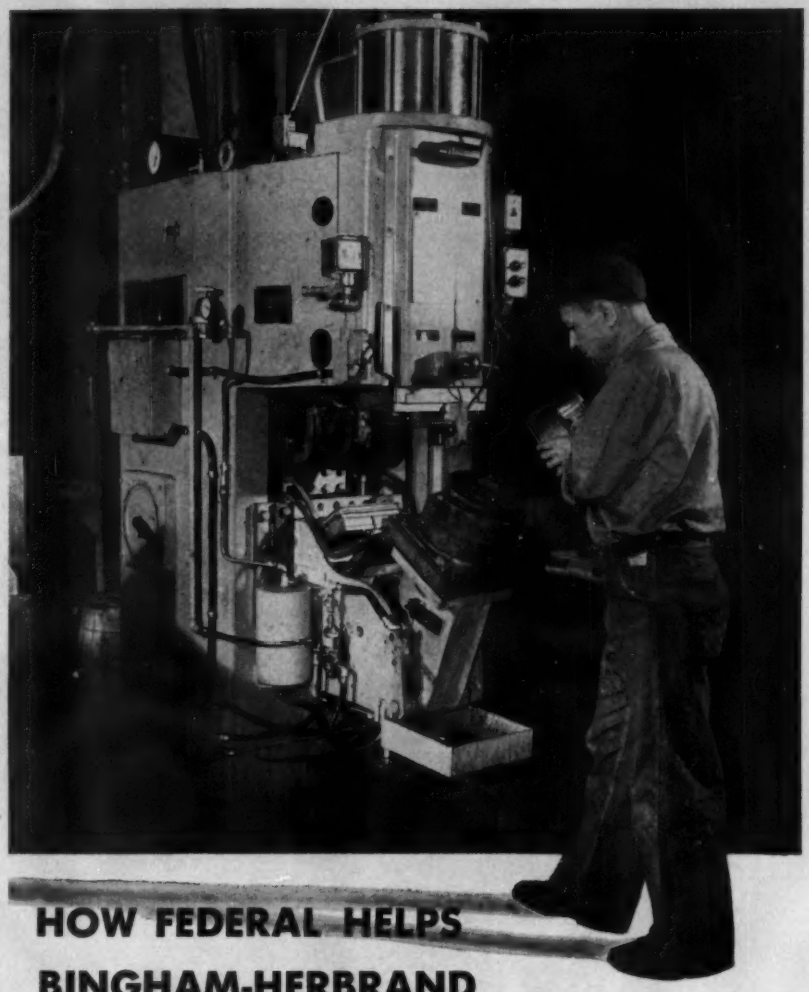
will order material and have his men work on a gadget for someone's home or boat, and all at company expenses. He does this because he expects the person receiving the favor to do him a favor in return, or sometimes because it gives him a feeling of importance.

When a foreman or department head is asked to perform a favor, he has two alternatives open to him. He can accept the request and do the favor, in which case he becomes a regular fellow. This makes him one of the boys, and permits him to request a favor in return. The other alternative is to think of the best interests of the company and refuse. In this case he will be branded as a company man, uncooperative, and a poor sport. He will soon find that his refusal is costing the company money because he has lost the cooperation of the other departments. It takes a man of great temerity to refuse to do a favor, and if he does refuse, he will properly regret it.

What can the owner and management do to prevent widespread abuses resulting from pull? The best way to limit this is for them to set a good example. If they have something to be repaired, or built, they should send it outside the plant. They can no doubt get it done at a reasonable price at one of their suppliers or subcontractors. If they have a friend or relative seeking employment they should have them apply in the regular manner. If unsuccessful, then the executive can use his influence to get the person an interview at a plant that they do business with. In addition to setting a good example, they should keep a careful check on the work being done in the shop.

Sing Yen
Brooklyn, NY

"Mr Vice-President in charge of parts is wanted on the phone—is that you?"



HOW FEDERAL HELPS BINGHAM-HERBRAND BUILD BETTER ASSEMBLIES

Bingham-Herbrand, Toledo, O., is one of the nation's foremost suppliers of fabricated parts and assemblies for the automotive and appliance industries. To maintain constant high quality, yet keep their prices competitive they must continually work at controlling their costs.

Before and after shots of a power unit case for appliance application.

Fifteen separate parts are welded together to make a completed unit.

It's this cost consciousness that has brought them to rely on Federal Resistance Welders. Their records show they get more production at less cost from Federal equipment.

Bingham-Herbrand is not alone in this respect . . . for wherever resistance welding units are a major operation and costs are important, you'll find machines by *Federal — First in Resistance Welding.*

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WARREN, OHIO

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These "WHEELS of PROGRESS" are establishing outstanding records of achievement and dependability.

They are uniform in density and hardness.

All shaped points are trued to exact size and shape *after* mounting on spindle, positive test of ability to hold to spindle . . . run-outs can't occur . . . ready for action, dressing before using not required.

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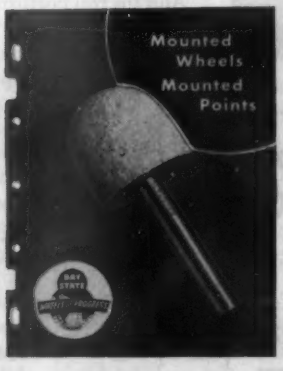

This New Mounted Point Handbook is packed with information about BAY STATE Mounted Wheels and Points, including bonds, lubricant treatments, etc. Send for your copy today.

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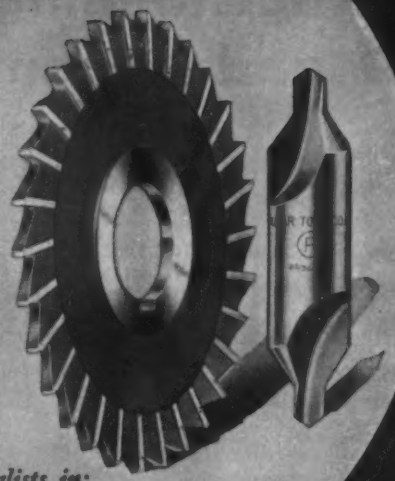

In our definitive new catalog you'll find Circle R products pictured and fully described, with size and price listings, ordering instructions, and helpful data on speeds and feeds for most effective metal cutting. As specialists, we make nothing but circular metal cutting tools — the finest you can buy, though they cost no more. We are consultants on metal-cutting problems throughout industry, with particular reference to the new problems of automation. Ask for your free reference copy of Catalog N. Write direct or contact our Circle R Specialists in your district.

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And for top performance at a low price, use Victor "Moly"® High Speed Steel blades. Victor developed this high speed, heavily-alloyed steel blade of molybdenum. Remember, "Moly" High Speed blades outlast standard steel blades 10 to 1, cut as well as the *best* high speed steel blades made, but are substantially lower in cost.

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Part I of a new 2-part *American Machinist* Special Report, dealing thoroughly with the many devices for holding work machined during *rotation*. Sixteen pages, fully illustrated, 25 cents per copy.

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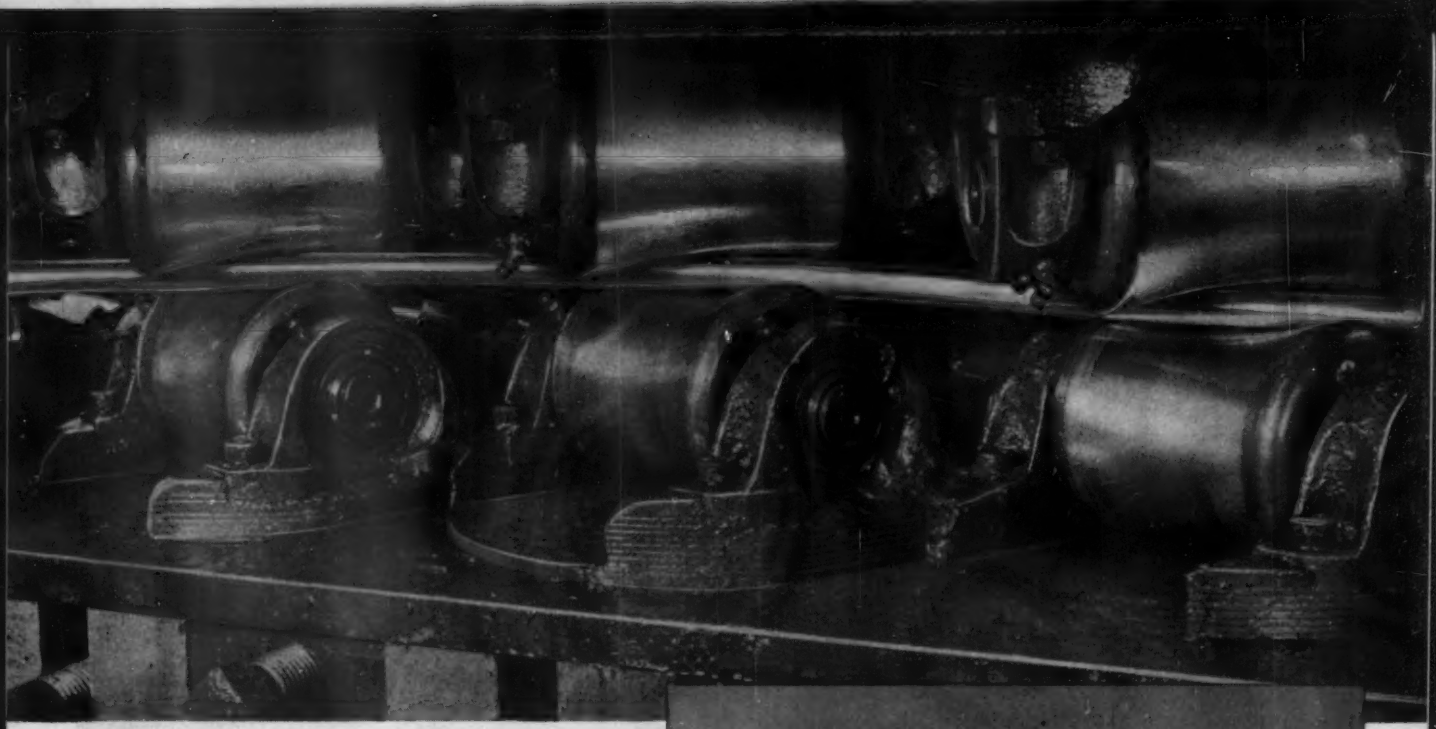


Here is the arrangement of rolls in the Mack-Hemp rotary tube straightener: six driven rolls, all adjustable for angularity, top three rolls and lower middle roll adjustable up and down. If desired, rolls can be set to produce a controlled amount of cold work or "temper" in soft tube.

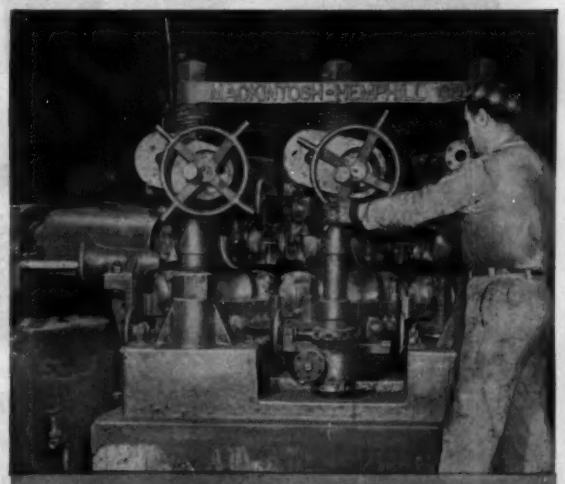
THIS UNIQUE ROTARY STRAIGHTENER GIVES YOU...

perfect tube straightness and roundness with unlimited speed

The Mack-Hemp rotary tube straightener works unhampered by tube guides at speeds limited only by tube feed and tube delivery tables. For example, the Mack-Hemp A-1, for 1" to 3½" O.D. tubing, has a normal production speed of 800 feet per minute. The big Model A-5, for pipe diameters up to 16" will run at 240 fpm. Model AXY with well-designed feed and delivery tables, has straightened ¾" brass tube at 500 fpm.

Even at these high speeds—made possible by driving all rolls—straightened tubing shows the accurate straightness and true roundness of best rotary straightening practice. O.D.'s and I.D.'s remain unchanged. And since Mack-Hemp straighteners need no guides, tube surfaces are free from blemishes.

If your present straightening equipment is slow or you're getting more than your share of customer complaints, write us today for Technical Bulletin No. 55, "How to Straighten Pipe and Tube." It's yours for the asking.



U. S. Steel's National Tube Division runs Mack-Hemp Model AO rotary straightener on continuous butt-weld steel pipe from .840" to 2.375" O.D. at speeds in the neighborhood of 700 fpm.

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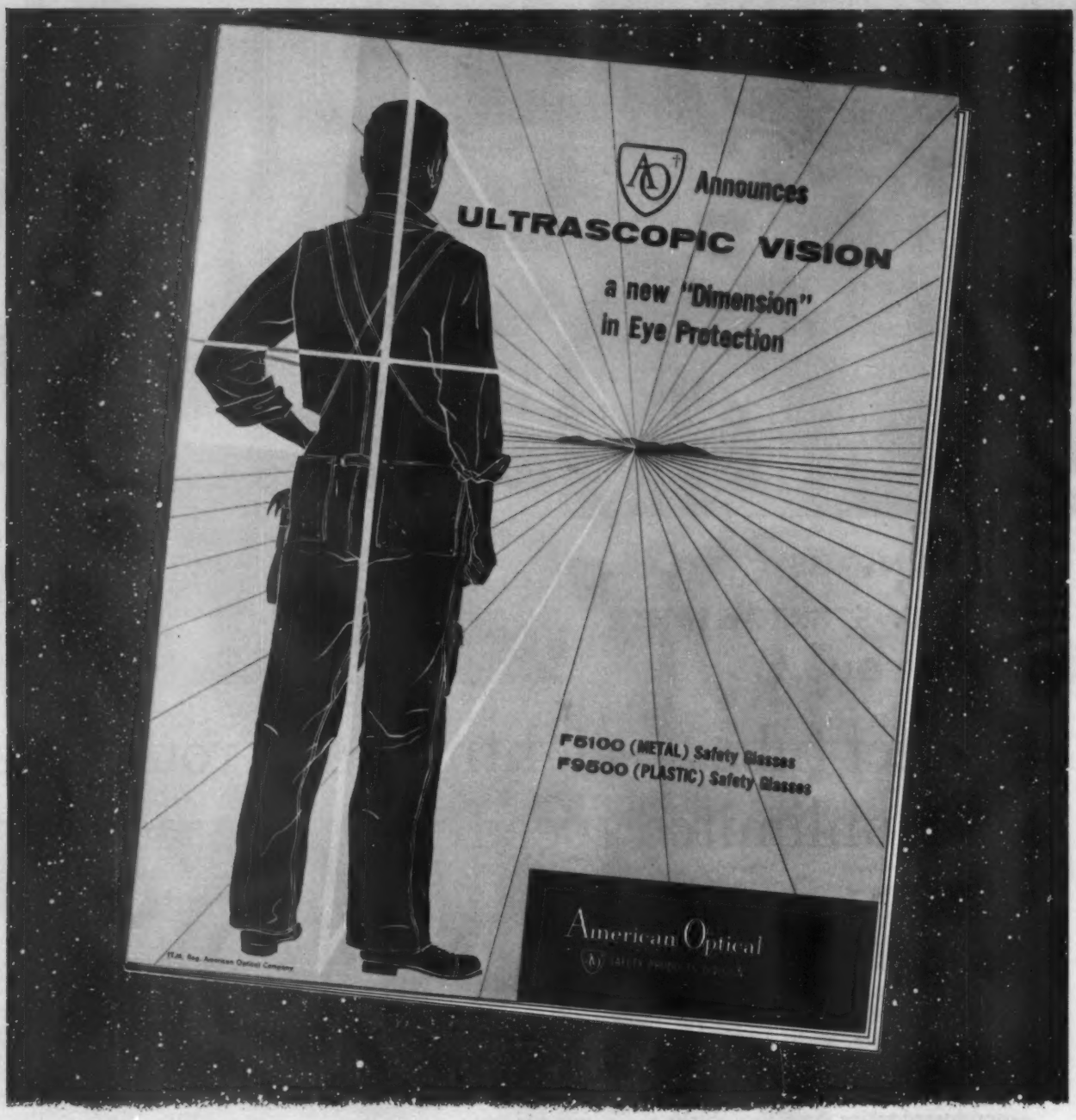
heavy-duty lathes • steel and special alloy castings • end-thrust bearings



To All Concerned with Industrial Safety:

Did you get <u>your</u> copy of AO's NEW Brochure on the "1956" Line of Ultrascopic Safety Glasses? Be sure to get it . . . these evolutionary products will make your protection job easier.

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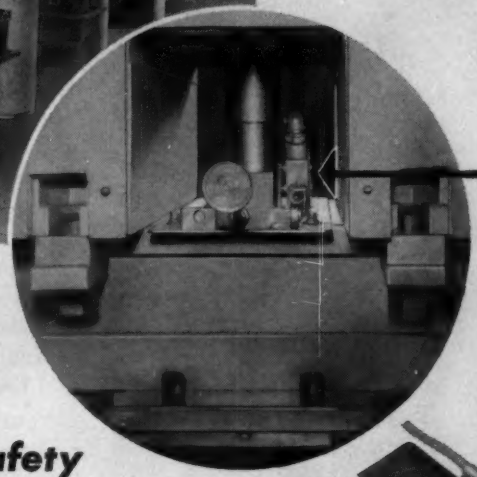
MICRO SWITCH Precision Switches
A PRINCIPLE OF GOOD DESIGN

Battery of 200 ton transfer molding presses on which MICRO SWITCH switches were installed to provide additional safety, reduce operator effort and speed up production.



Simple actuating device eliminates reaching into the hot press mold to set plastic preforms in position. High temperature switch operates within confines of the mold.

Plant Engineer uses snap-action switch

to { *provide additional safety* / *reduce operator effort* / *speed up production* }

on 200 ton transfer molding presses

PROBLEM—Preheated plastic preforms were manually placed in the hot mold of the 200 ton transfer molding press. The operator then withdrew his hand to operate the control switch on the side of the press to start the molding sequence. Hand and arm were exposed to burns and injury from accidental ram operation.

SOLUTION—The plant engineer installed a plunger actuated switch within the mold and wired it into the ram control circuit. He made the special device (shown) with which to push the plastic preforms into proper position in the mold and, at the same time, operate switch to start the ram motion.

RESULT—The operator's hand and arm are never in the danger zone and, with one motion, the plastic preform is positioned in the press and the molding sequence started—automatically.

Plant engineers everywhere use these long-lived, precise switches as automatic checking controls and gages to insure quality of finished products. They use them as limits, safeties, interlocks and controls to increase production efficiency at minimum cost and with maximum safety.

There is a MICRO SWITCH *Distributor near you with a complete line of snap-action switches for every requirement. Look in the Yellow Pages under "Switches, Electric."*

A complete line of snap-action and mercury switches

MICRO SWITCH provides a complete line of extremely reliable, small-size, high-capacity, snap-action precision switches and mercury switches. Available in a wide variety of sizes, shapes, weights, actuators and electrical characteristics. For all types of electrical controls.

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A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

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Improved Scully-Jones Tools reduce drilling and tapping costs!

More trouble-free production is now possible on multiple-spindle machines equipped with *improved* Scully-Jones Quick-Lock Adjustable Adapters. The new "Keyhole" slot and Ejector make tool changes faster, easier, and safer. The pilot nose minimizes any tendency of adapters to bind or jam in the spindle. Your machines are protected against misalignment and damage by these easy-operating, more accurately fitting tools. And, with quick and easy adjustments of the Quick-Lock Nut, you speed setup and accurately control cutting tool depth.

More good news! Scully-Jones Drill Chucks . . . offering increased resistance to "pull-out," improved seating, and truer collet action . . . are now available from stock. The new four-slot design gives you all the advantages of small diameter, plus added protection against tool breakage and production shutdowns.

Your factory-trained Scully-Jones representative or distributor can demonstrate these advantages to you, and explain why Scully-Jones tools hold accuracy and last longer, even under hard usage.

Next time you buy *or build* a machine tool, make sure it's equipped with Scully-Jones "Precision Holding" tools.

Let your factory-trained Scully-Jones representative or distributor help you select the right tool for the job.

SCULLY JONES

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"Precision Holding" for holding precision

Floating Holders | Adjustable Adapters | Safe-Torque Tap Drivers | Milling Machine Adapters | Close-Centers Tap Drivers | Quick-Change Chucks | Heavy-Duty Tap Drivers | Drill and Tap Drivers | Recessing Tools

WHICH DIE STEEL WOULD YOU USE HERE to increase production from 100 to 23,000 parts?

Even after trying many different die steels, production averaged only about 100 pieces before this ring die had to be replaced.

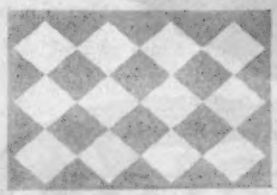
The die cold forms cups as the first operation in producing rocket projectile noses from SAE 1010 Steel. Even though the ring die is press fitted into a four foot diameter hardened retainer ring (Rc. 34/36), the 1700 tons of pressure exerted in power extrusion prematurely stretches the die. The 12 lb. 2 oz. cups must be held within .2 of a lb. and wall thickness within .010".

Which die steel would you specify in a move to cut replacement costs and improve production?

From our customer Field Report files, here's how the toolroom solved the problem. The Carpenter Matched Set Method showed that Carpenter VEGA (Air-Tough) Die Steel was a natural for the job. Latest report shows that the VEGA ring die had increased production from 100 to 23,000 cups, and is still banging them out.

What better guarantee of success can you find for your own jobs than the word of hundreds of toolroom men who rely on Carpenter. Why settle for "ordinary" results when Carpenter is ready to help you explore the possibility for improvement? Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now. *The Carpenter Steel Co., 109 W. Bern St., Reading, Pa.*

How can <u>your</u> toolroom use Carpenter Matched Tool and Die Steels to:



Reduce hardening hazards
Minimize machine downtime
Boost output per grind
Improve product quality

Carpenter STEEL

Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks — Export Address: Port Washington, N. Y. — "CARSTEELCO"

MBI

• greater production
• lower costs
• smaller investment

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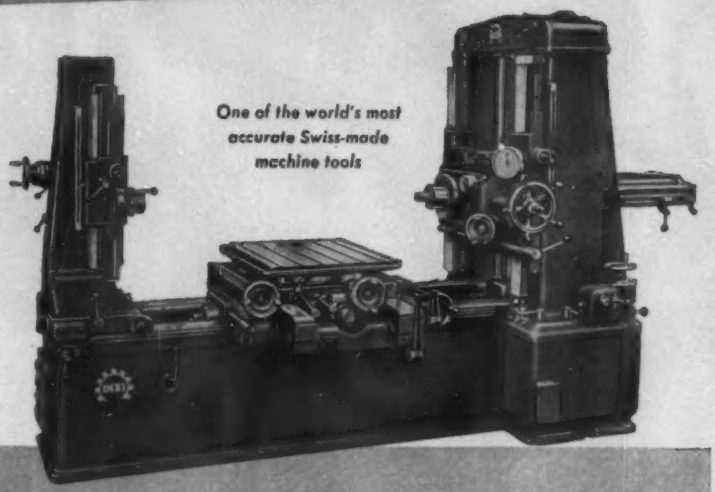
Dixi 60

Horizontal Jig Borer

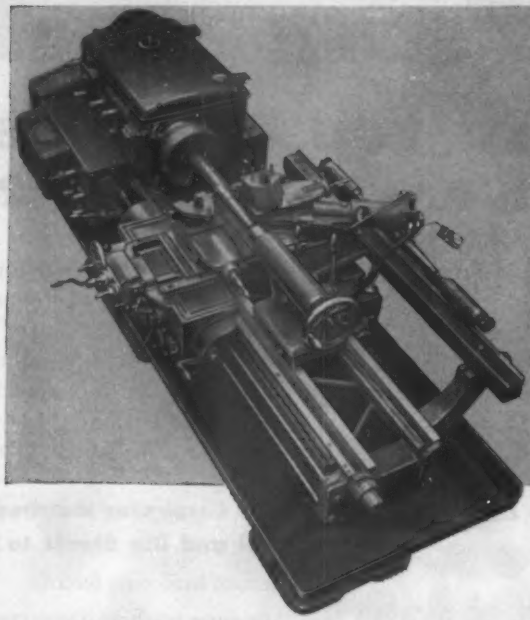
With 5 optical microscopes

A precision machine for boring, drilling, recessing, and milling work. Built-in rotary table with optical microscope can be rotated 360°. Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Table and spindle head have variable hydraulic feed. Mechanical spindle feed can be changed without stopping spindle and is provided with automatic depth stop.

No. 40 taper spindle. Spindle speeds 32-1350 R.P.M. Feeds .0015"—.010" per rev. Table size 28¾" x 32⅝" max. distance spindle to table 19¾". Table travel 23⅝". Spindle travel 24.4".



One of the world's most accurate Swiss-made machine tools



Heavy Duty Lathe *High Precision, Reliability, Top Performance Schaerer Model UN-450*

Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permit rough turning and finish turning in the same operation in many instances. Swings 17¾" over bed, 9" over carriage, 20-5/64" over gap. Center distance 60". Spindle speeds 31.5 to 1400 R.P.M.

Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pump. A production lathe built to tool room standards.

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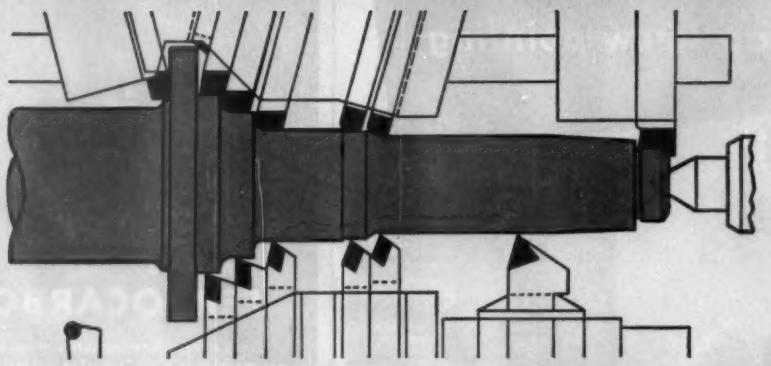
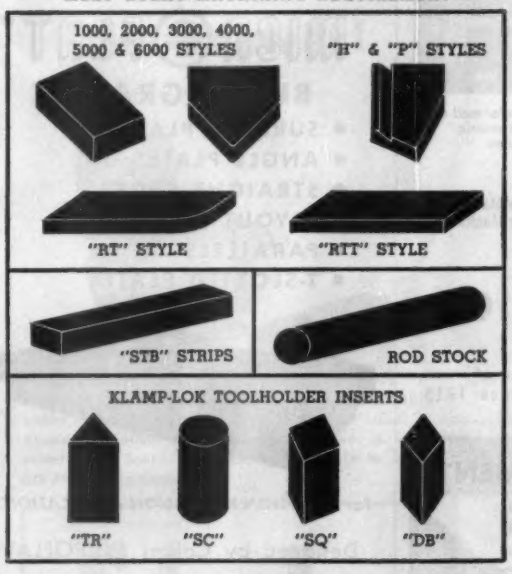


PRODUCTION RATE—UP 25%, TOOL COST—DOWN 40%
AT LARGE MID-WEST TRACTOR PLANT

PART.....Shaft Steering Clutch, SAE 8654-H Brinell 370.
OPERATION.....Rough Straddle Face Flange, turn all diameters, form undercut and base.
MACHINE.....16 x 60 Sunstrand Automatic Lathe.
TOOLS.....8 Talide-tipped facing, chamfering, radius and form tools Grade S-88. 7 Klamp-Lok Toolholders with round, triangular and parallelogram Talide inserts Grade S-88.
DEPTH OF CUT..9/32" to 7/16"
FEED.....022
S.F.M.....156
RESULTS.....Production up 25%—Scrap and rejects down.

A FULL LINE OF TALIDE TIPS IS AVAILABLE IN OVER 1000 SIZES, STYLES, SHAPES AND GRADES—TO MEET EVERY MACHINING REQUIREMENT



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An extensive 2-year research and development program has resulted in a completely new and improved series of Talide Metal grades for all-purpose machining. "Double-carbides" containing tantalum carbide and tungsten carbide have been perfected for cutting cast iron and non-ferrous alloys, and "triple-carbides" containing tantalum carbide, titanium carbide and tungsten carbide for machining steels.

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Laboratory tests reveal that these new, improved grades have 25% greater strength and rigidity. Extensive field tests have proven that service life per grind is increased up to 50% over previous grades. **Metal Carbides Corporation, Youngstown 7, Ohio.**

Send for new 84-page Catalog No. 55-G.

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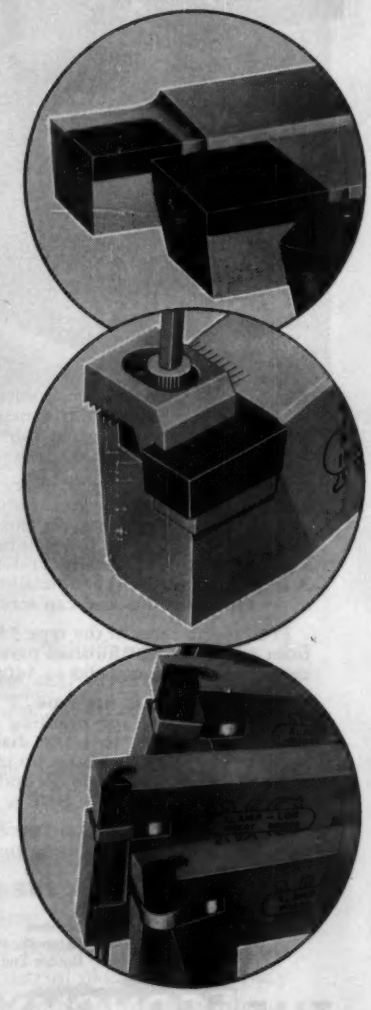

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MC
TALIDE®
YOUNGSTOWN 7, OHIO

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HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Automatic
POINTING MACHINES
for bolt and cap screw pointing

TYPE 4600

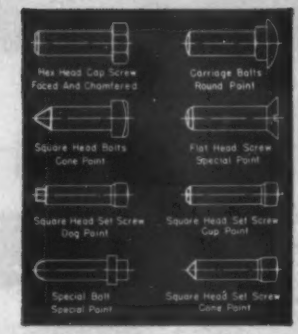
ECONOMY Automatic Pointing Machines are hopper fed and automatic in operation. These features enable operator to run several machines resulting in greater productivity and lower costs.

These Automatic Pointers are available in two sizes—Type 3300 for uniformly pointing bolts and screws to 3/8" diameter and 3/4" to 3-1/2" in length, the type 4600 for pointing bolts and cap screws 1/4" to 3/4" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

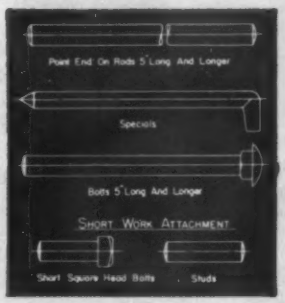
Production rates of the type 3300 vary infinitely from 2,000 to 6,000 finished parts per hour and on the type 4600 from 1800 to 5400 per hour.

Also available is the type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods 1/4" to 1-1/2" diameter, 5" or more in length. Production rates up to 2,000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.


Hex Head Cap Screw Faced And Chamfered
Carriage Bolts Round Point
Square Head Bolts Cone Point
Flat Head Screw Special Point
Square Head Set Screw Dog Point
Square Head Set Screw Cup Point
Special Bolt Special Point
Square Head Set Screw Cone Point

Typical parts machined on the TYPE 4600



Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing & Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Double End Automatic Pointing Machines

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WILLOUGHBY, OHIO

Designers and Manufacturers of Secondary Operation Machines since 1915

UNIT MACHINING COST CUT 17% ON THIS GRAY IRON CASTING

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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE... because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

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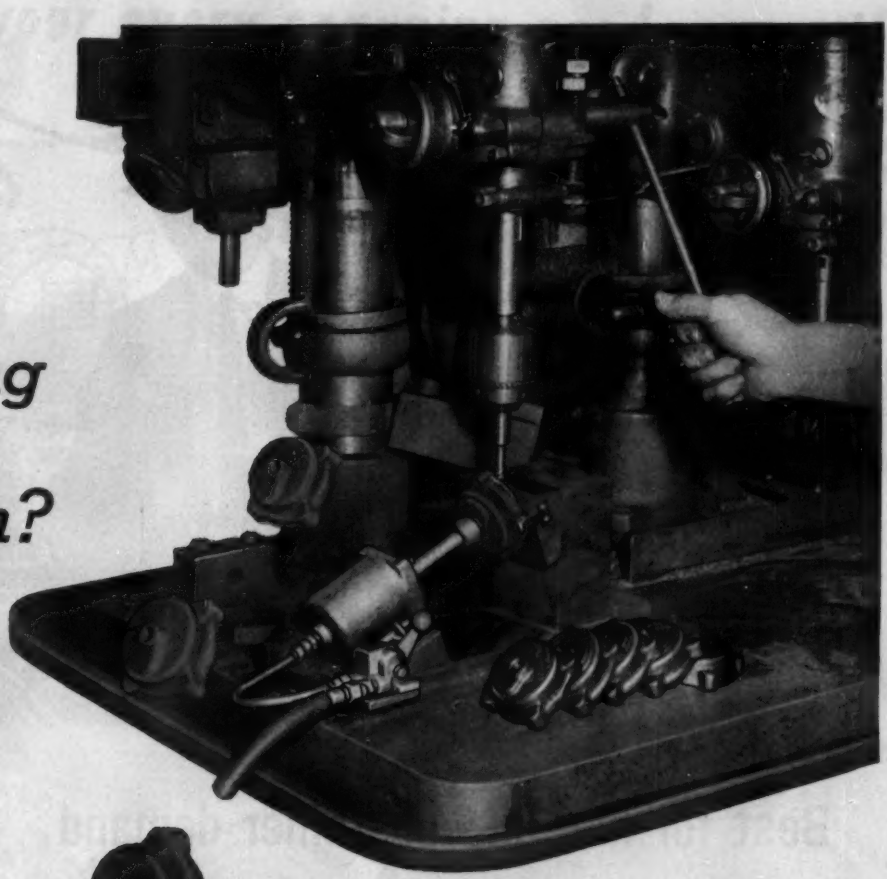
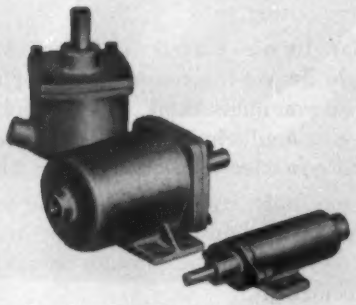
Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader

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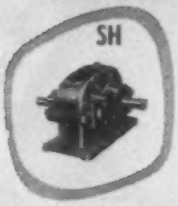

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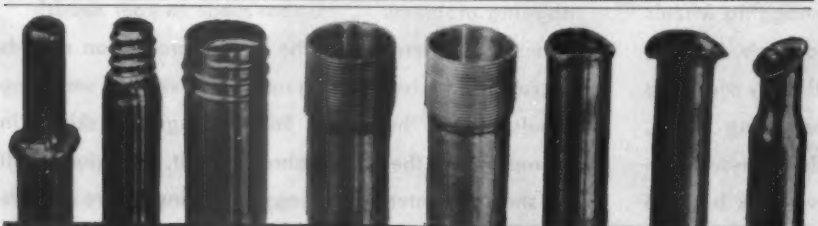

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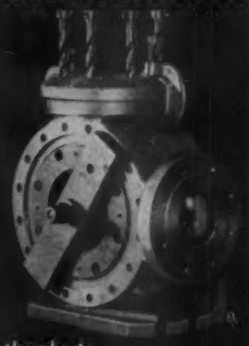

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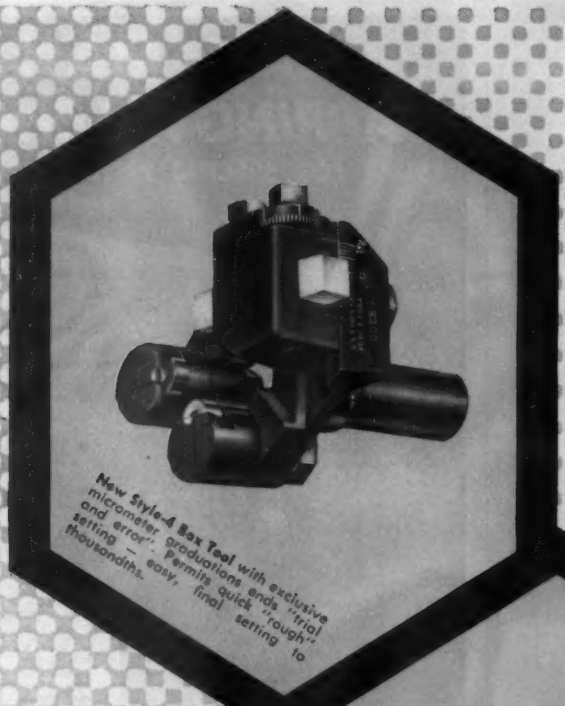

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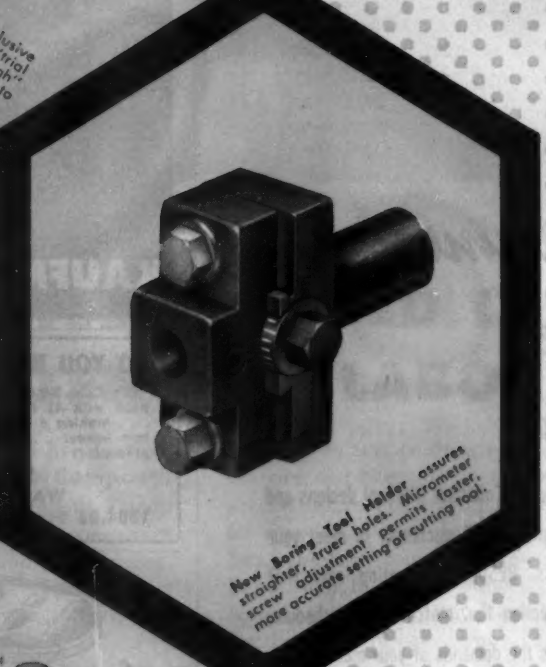

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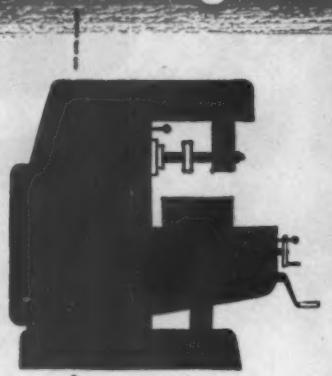

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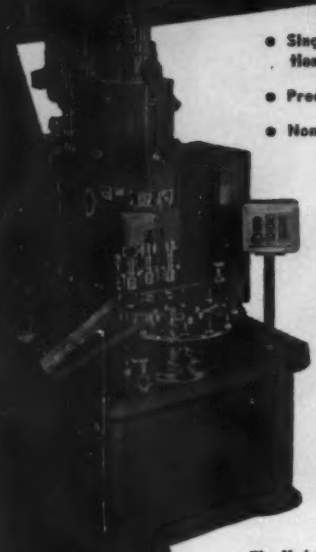

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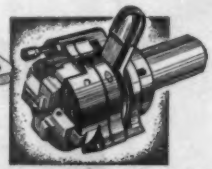

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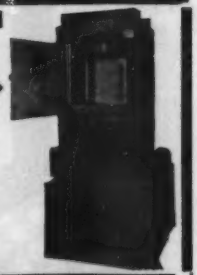

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"Increased tool life 50%, lowered production costs," says the Toledo Pressed Steel Company. Fabricating 600 to 700 tons of steel per month, Toledo Pressed Steel is one of the largest stamping companies in Toledo, Ohio. From its 78 punch and draw presses, ranging from five to 500 tons, come truck flares, road construction torches, radio and television parts, and stampings for the automotive industry.

Volume operation? You bet! . . . the kind where the right lubrication makes a big mark in the profit column. And the right lubrication for Toledo Pressed Steel has been Cities Service Lubrication.

Says Plant Manager Walter Baird: "We have been using Cities Service drawing oils for nine years on all drawing and stamping operations. Previously we used several different compounds. But now with Cities Service drawing oils, we have increased tool and die life 50%, which, of course, has lowered production costs. In addition, they have reduced die maintenance labor costs about 25% compared to our former oils, and offer the bonus of easy removal from stampings where plating is necessary."

A Cities Service Lubrication Engineer can help you achieve similar results in your operation. Why not call him in. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

Road Construction Torches are one of the many products of Toledo's 78 punch and draw presses. These torches cost less to produce due to firm's use of Cities Service drawing oil.

Plant Manager Walter Baird with some of company's products . . . construction flares, metal stampings for automotive manufacturers and numerous radio and television parts.

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1 provides close sizing on infeed grinding to very low tolerances

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The U. S. VULCANITE Centerless

The U. S. Vulcanite Centerless Regulating Wheel is shown on a grinder, above. This wheel requires less infeed, enabling the operator to hold size better. Unusually close tolerances can be attained. The wheel has a snug arbor hole and runs true.

Here is a wheel that has 2 solid years of development behind it—all done by United States Rubber Company technicians. *The needs of customers were carefully studied.* Industry required a durable and economical wheel that would meet the 2 conditions named above. And U. S. VULCANITE is that wheel.

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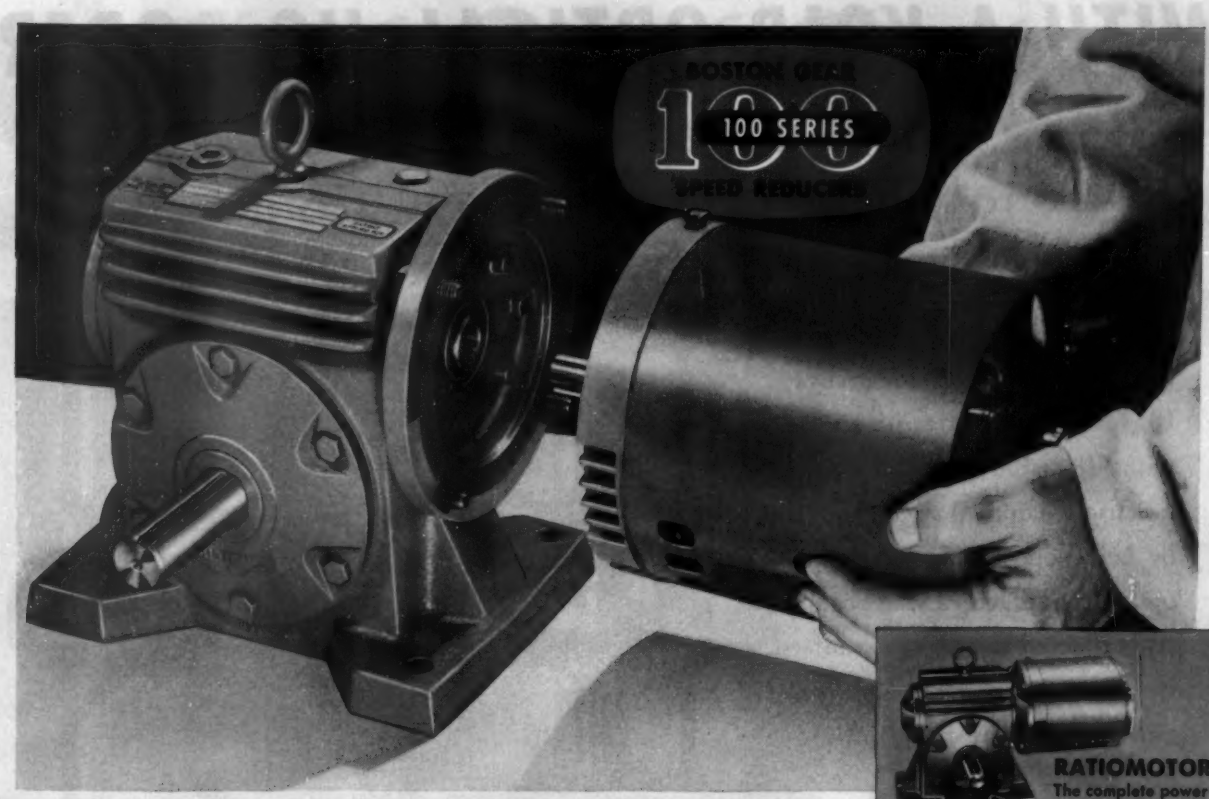

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The complete power package, with motor.

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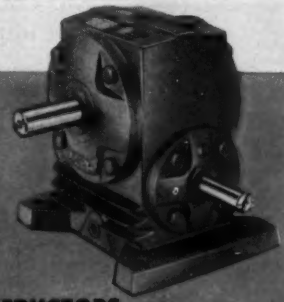
The Ratiomotor gear unit, supplied without motor. You buy and attach any motor you choose.



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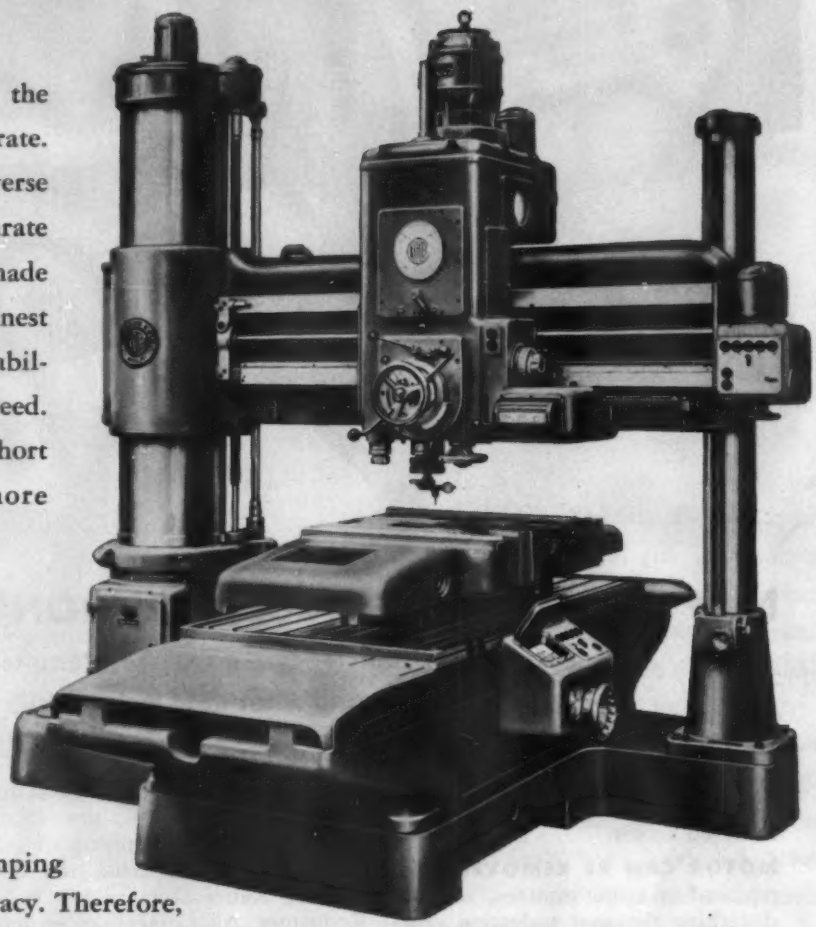

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Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

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Notching Die Made of Bearcat Gives 7 Times Greater Output

An interesting item being manufactured in the southeastern part of the country is a windshield garnish molding for a popular make of automobile. The molding is produced from cold-rolled steel, 0.020 in. thick. It is formed by a notching die, hardened to Rockwell C 56-58.

With the grades of shock-resisting tool steel formerly used for the die, a maximum of 1400 pieces was produced before breakage occurred. Because of the severity of the application, this was considered good production even though it necessitated a change of die about five times daily.

After studying the operation, we suggested a change to Bearcat tool steel. "Bearcat is a super shock-resisting grade," we said. "We're sure it will last longer in a tough job like this, and so save you money. Why don't you give it a try?"

So Bearcat was put to work. The dies made of Bearcat have been giving a good account of themselves by producing up to 10,000 pieces before being replaced. That's seven times the output obtained from the dies before changing to Bearcat.

Surprising? Not at all. Bearcat is continually chalking up new performance records in a variety of interesting applications. Bearcat is a superior, general-purpose grade of air-hardening tool steel. It has exceptional resistance to shock, and is also well suited for uses where hot-work properties and easy machining are essential. Bearcat can be used in a wide range of applications such as punches, master hobs, engraving dies, and short-run dies used in cold-forming, blanking and bending.

The best way to determine how good a job Bearcat can do is to put it to work on some difficult job in your shop. You can order Bearcat through your local Bethlehem tool-steel distributor. We also carry it in stock in our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

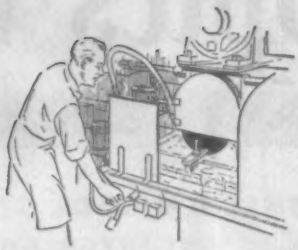
Retemper Tools After Grinding

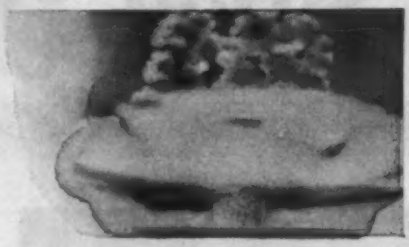
No matter how carefully performed, grinding operations on hardened tools always generate residual stresses in the tools. But as tools already contain residual stresses after they are quenched, any additional stresses are likely to cause trouble. Now, if the combined stresses are sufficiently high, cracking may occur during grinding, which makes it easy to locate the source of the trouble. But if the combined residual stresses are just below the ultimate strength of the steel, cracks will not appear for the time being. Instead, the tools are apt to crack subsequently, at the application of normal stresses set up either in handling, or in using the tools.

To avoid this difficulty, we recommend reducing the stresses to a safe level by retempering the tools immediately after grinding, using a temperature which is slightly lower than the original tempering temperature. With many toolmakers, retempering after grinding is routine procedure, a form of insurance, more or less, against running into trouble.

BLANKING DIE FOR HANDBAG HANDLES

This blanking die, used by Westberg Tool and Manufacturing Company, Bridgeport, Conn., for the manufacture of handbag handles, has BTR (Bethlehem Tool Room) tool steel in both the die and the punch. BTR is our long-wearing, general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel.





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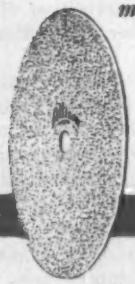
Modern industry recognizes the key importance of "new" high-temperature-resistant alloys in the development of jet engines and atomic energy. Neither development would have been possible otherwise. Yet too few production managers know about the valuable assist rendered by Allison Abrasive Cutting. *Abrasive cutting has consistently proved itself the only economical and efficient method for cutting these extremely tough wonder metals.*



Allison wheels have been developed to cut any of these metals. They are standard wheels, requiring no special machines or cutting techniques.

Tough Cut-Off Jobs Are Easy . . . with Allison.

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C & J 12-SPEED GEARED HEAD LATHES

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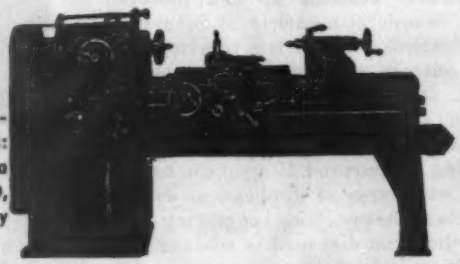

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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged *89.5%* greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE . . . because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

FOR FREE BOOKLET on FERROCARBO, citing actual case histories of faster machining, with longer tool life, write The Carborundum Company, Dept. 13, Niagara Falls, N.Y.

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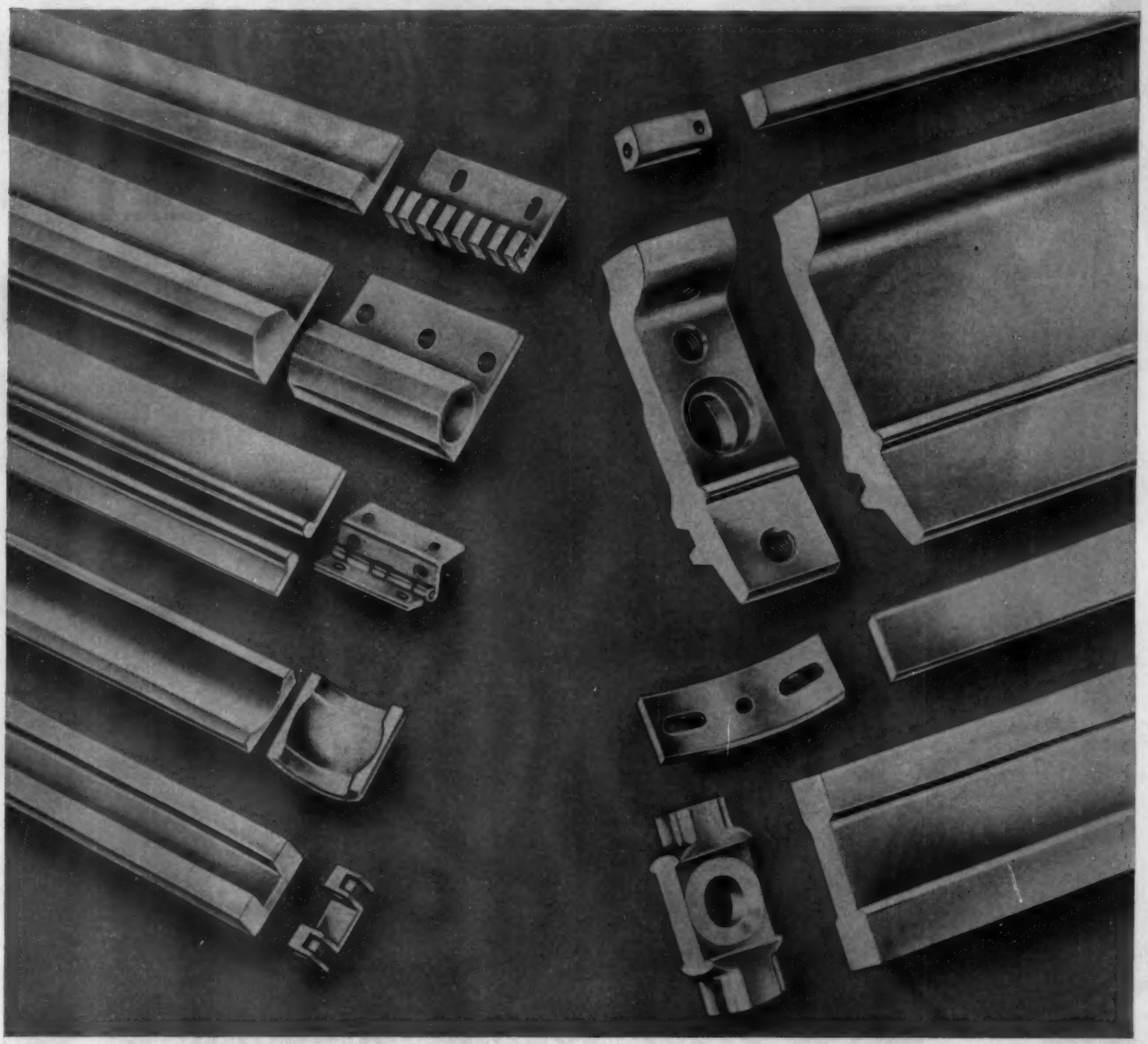
A SHORT CUT TO A FINISHED PRODUCT



REDUCE YOUR MACHINING OPERATIONS, REDUCE SCRAP

get a superior wrought metal product with Anaconda extruded shapes

Cost-paring possibilities unlimited: In few areas can imagination and ingenuity pay off so handsomely as when applied to the use of extruded shapes. Visualize your finished parts as cross-sectional pieces cut from a long extruded shape.

Costs come down, quality goes up: Extruded metal is *wrought* metal—tough, dense-grained, smooth-surfaced, and easy to machine. When you switch from cast parts, you eliminate rejects due to pits and porosity; you reduce machining, scrap... and finishing time.

A manufacturer of hosiery knitting machines, for example, found he saved from 25-30% over cast brass. He makes 420 components from 12 different ANACONDA Extruded and Drawn Brass Shapes. He also gets the superior precision, balance, and long-wearing and bearing qualities in these parts, which must operate at high speeds.

Metals: Extruded shapes are available in copper, brass, bronze, and special copper alloys—in long mill lengths suitable for feeding into turret lathes or automatic screw machines.

Our experience at your service: The American Brass Company pioneered in extruded shapes. The accumulated experience of the organization, its wide selection of dies, may help you short-cut production and save money.

We'll be glad to make suggestions based on your sketch or sample. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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DISSTON STAINLESS STEEL

...hot rolled to SHAPE

saves steel · tooling · machining

Stainless steel users receive many advantages by ordering Disston steel shapes accurately rolled to their specifications.

LESS MACHINING. Tool operations are simplified, for Disston shapes are rolled to precision tolerances, have exceptionally fine finishes.

REDUCTION IN WASTE MATERIAL. Preshaped Disston steel reduces scrap losses. One well-known manufacturer saved 47% of stainless steel tonnage by starting with a rolled Disston shape—instead of a rectangular section.

LOW-COST HANDLING OF SMALL ORDERS. Jobs as little as five or ten tons on a particular shape are rolled easily, economically in the Disston mills. Over 100 years of leadership in the rolling of special shapes gives Disston the edge in metal-shaping skill and technique.

Why not talk over your requirements with a Disston representative? Learn how much you can save by using Disston stainless steel shapes. Or write to:

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DISSTON HAS THE EDGE®
in special purpose steels
and special steel shapes.

100 YEARS OF FINE STEEL MAKING

a challenge to the rated capacity of your present hand turret lathes!

Compare your present

1. output
2. tolerances
3. set-up time
4. rejects

with a new RIVETT 918ST – *and get the startling proof of how much you can increase output per machine per manhour!*

Evidence from RIVETT customers shows that—

1. Instant Start-Stop of Spindle Doubles Output (even on short runs of varied pieces)
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3. Simplified Tooling Cuts Set-up Time in Half!
4. Rejects—NEXT TO NOTHING

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The Container Line That's Changing Industry's Handling Habits

● Thoroughly tested—proved the easiest, fastest, most inexpensive method for handling of parts and components in mass production operations — the **Powell Flow-matic* System.**

Wherever this system has been set into operation handling costs have been substantially reduced. Those who have seen it in operation agree its the finest yet . . . sure to effect a great change in the handling habits of industry.

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*T.M. Powell Pressed Steel Co.

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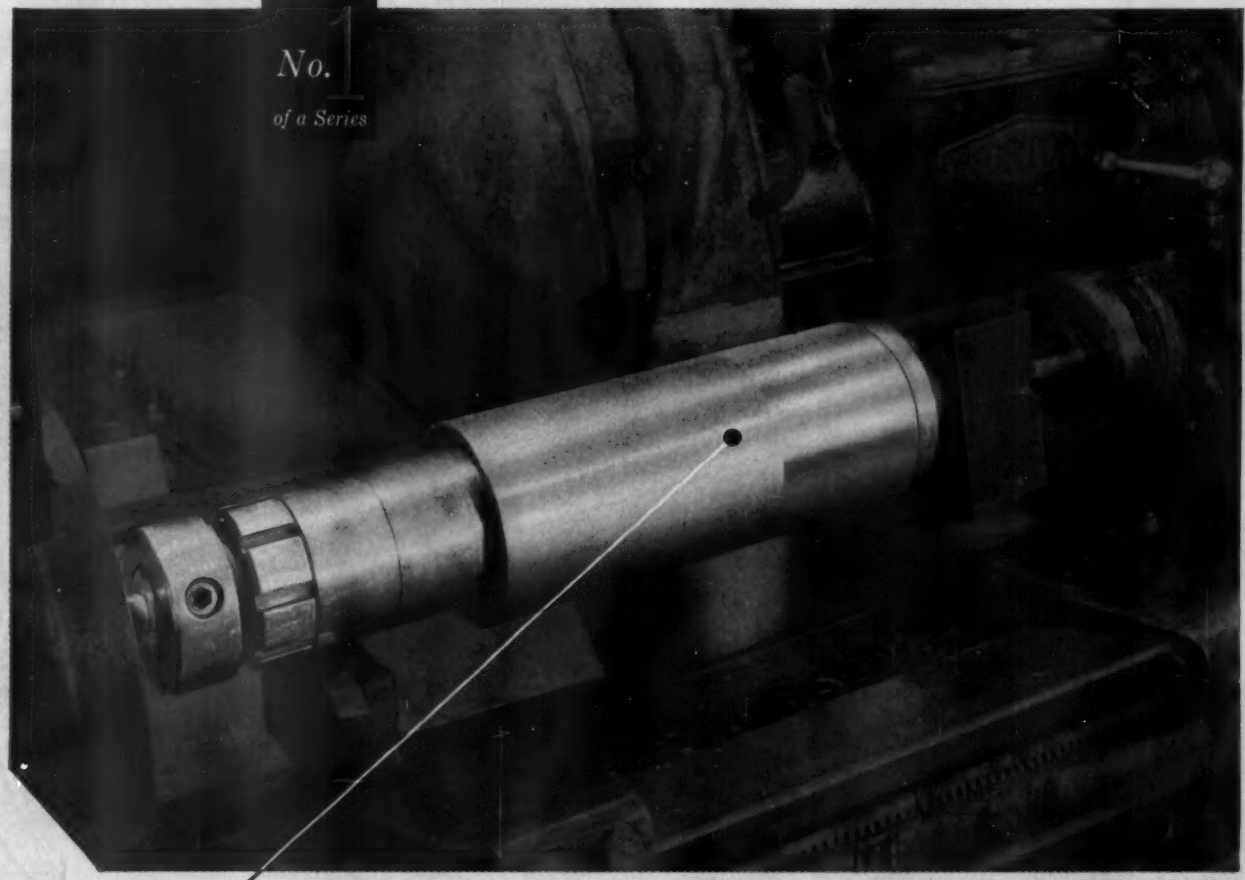
Erickson Precision Expanding Mandrels Solve Grinding Problems

No. 1 of a Series



Photos Courtesy Thompson Products, Inc., Clarkwood Rd. Plant, Cleveland, Ohio

e.g. engine cylinder liners

Thompson Products, Inc., leading automotive and aircraft parts producer, originally bought Erickson precision expanding mandrels to secure better concentricity and wall thickness of a cylinder liner . . . they had formerly used single taper type expanding sleeves.

Erickson mandrels grip over the entire I.D. surface of the liner . . . thus insuring a uniform wall thickness. So Thompson switched to Erickson precision expanding mandrels for rough machining and grinding, as well as checking.

AA-2233

Collet Chucks
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Tap Chucks

ERICKSON Holding Tools

.0003 Guaranteed Accuracy

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Tap Holders
Air-Operated Chucks
Expanding Mandrels
Special Holding Fixtures

Instantaneous self-release speeds loading and unloading. Application (above) uses multiple-sleeve construction to hold work part along its entire length for utmost precision.

Bothered by a tough internal holding problem? Then let us show you how Erickson mandrels speed production, lower grinding costs. Call us or write for Catalog K.

STRONGER, SAFER, STREAMLINED CONSTRUCTION

... with Phillips Cross-Recessed-Head Screws

"ASSEMBLY IMPROVED IMMEDIATELY when we began using Phillips screws," relates the assistant purchasing agent of Fasco Industries, Rochester, N. Y., leading makers of shaded pole motors, blowers, fans and ventilators. "Now we can use mechanical drivers that save plenty of time. Burring seldom happens any more. Product appearance couldn't be better. Whether inside for extra sturdiness, or outside for extra dressiness, we use Phillips screws almost exclusively!"

MORALE AND PRODUCTION SOARED with changeover to Phillips screws, which now comprise more than 92% of all screws used at Yankee Metal Products Corporation, Norwalk, Conn. Makers of auto lamps, mirrors and safety equipment since 1915, Yankee depends on many types of Phillips heads — both unplated and chromed to match accessories. Yankee's Merchandising Director says happily, "Phillips screws for extra safety, speed and ease of use really build plant morale and incentive earnings!"

EXTREME ANGLES NO PROBLEM where tightness is vital as in this fan assembly built by leading small motors manufacturer A. C. Gilbert of New Haven, Conn., to withstand lifelong vibration. Single-slot screws proved treacherous and expensive in time and damage loss. An executive engineer for Gilbert says, "Using Phillips screws for over 10 years, we have learned that, for all around production efficiency, Phillips are the best."

MANUFACTURERS OF PHILLIPS CROSS-RECESSED-HEAD SCREWS

THE FASTENERS OF TODAY
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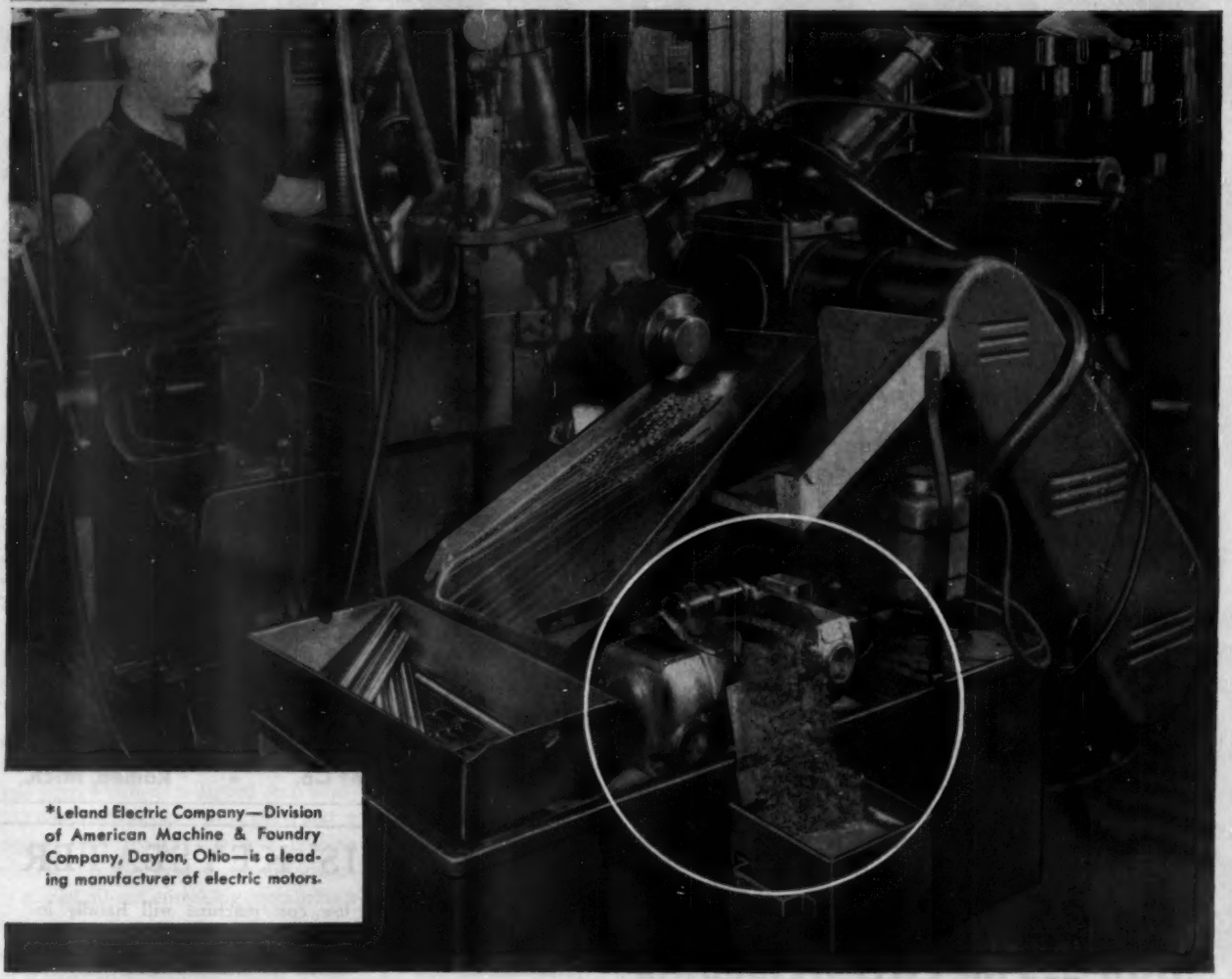
HOUDAILLE MAGNETIC SEPARATORS

save $2230 annually for Leland Electric Company*



*Leland Electric Company—Division of American Machine & Foundry Company, Dayton, Ohio—is a leading manufacturer of electric motors.

● Coolant contamination is no longer a problem in Leland Electric's armature shaft grinding department.

Five Houdaille Magnetic Separators—mounted on grinder sumps—provide machines with a constant supply of clean coolant. Separator shown above removes 62 pounds of metallic chips and sludge daily.

Annual savings in coolant and maintenance costs total $2230. Other benefits include longer wheel life, better product finish, more sanitary working conditions.

The Houdaille Magnetic Separator is designed for complete removal of ferrous metal chips and abrasives. Compact, lightweight, easy to install. Uses no floor space, needs no separate pump and motor. 10, 20, 40 GPM capacities. Write for Equipment Bulletin 601 and 4-page Leland case history.

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M-100

the PRECISION BENCH DRILLING MACHINE

No ordinary bench drilling machine, but an extremely accurate, high speed, sensitive machine for precision drilling. Drills from ¼" down to extremely small sizes. Successfully used down as far as .008".

Table and column exactly squared, one to the other, and built with strength and rigidity for maintained accuracy. Hardened and ground spindles insure long life. Sealed ball bearings throughout for smooth operation from 4,000 r.p.m. to 10,000 r.p.m. Motor, driving belt, and spindles entirely enclosed for safety. Available with 1, 2, 3 and 4 spindles.

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No collet chuck is as versatile, can grip as tightly or as accurately as the new Chukollet. Can be used on any machine in the shop.

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Practical Data on Popular Analyses of Tool Steels, their Selection, Heat Treatment, and Use

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Talking About Die Sets

WITH

PHIL MARSILIUS

Vice-President
The Producto Machine Co.

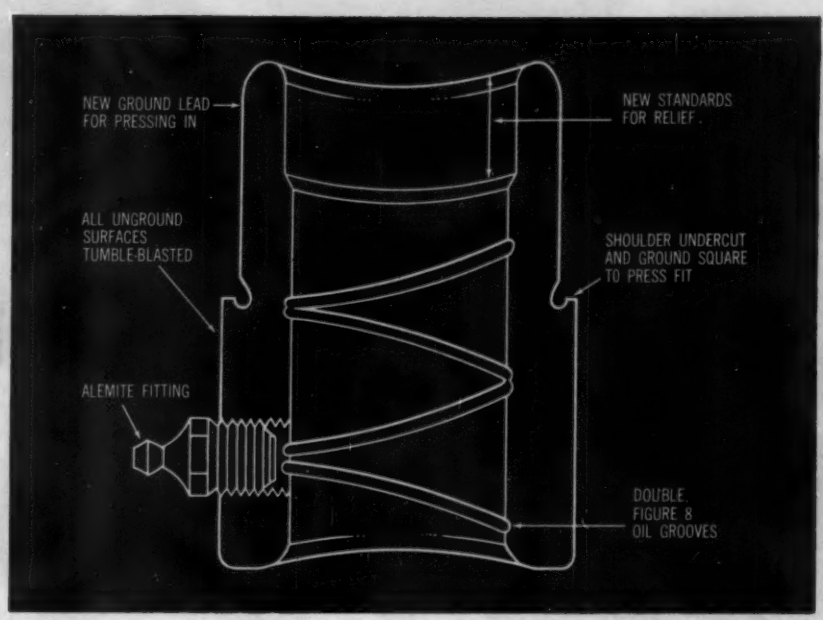
Lubricate for Longer Life—Faulty or insufficient lubrication of guide pins and bushings can result in a rapid reduction in the accuracy of die operation. Since the relationship between wear and friction is a direct ratio, proper lubrication greatly reduces wear and increases the useful life of pins and bushings. There are many fields of thought as to the type of lubricant best suited to die set operations at different speeds and varied accuracy requirements. The type used depends on the experience of the press-room foreman. The method of application also varies widely to suit individual needs.

Standard lubrication methods involve a simple oil groove in the bushing. Here are a few inexpensive systems using the guide pin bushing as a source of lubrication: 1. Relief in the top of bushing is loaded with oil or grease; 2. Oil caps that feed oil into either a circular or Figure 8 groove in bushing through a hole in bushing wall; 3. An oil or grease fitting through which lubricant is forced manually as the need arises; 4. An oil reservoir cup that fits snugly over pin and from which oil is dipped onto bushing with each stroke of the press and is drawn up to completely coat bearing surface of pin for next downward stroke; 5. A steel oil-retaining ring containing a felt washer that fits over pin and slides up and down by spring-loading action or is attached to bushing.

Guide pins also have been made with oil grooves around the circumference or with splines or slots along the length, fed from inside through small connecting holes. Here, of course, bearing surface is somewhat reduced and pins tend to pick up dirt or chips.

Another method minimizes the amount of lubrication required. Bushings are made of bronze or other "soft" materials which hold lubricant in their surface while at the same time reducing friction normally encountered with like metal contact.

Whatever method you choose, proper lubrication will add life to your die sets and help maintain die accuracy.


NEW GROUND LEAD FOR PRESSING IN
NEW STANDARDS FOR RELIEF
ALL UNGROUND SURFACES TUMBLE-BLASTED
SHOULDER UNDERCUT AND GROUND SQUARE TO PRESS FIT
ALEMITE FITTING
DOUBLE FIGURE 8 OIL GROOVES

Cutaway drawing of new Producto bushing

NEW PRODUCTO BUSHINGS IMPROVE DIE SET ACCURACY, APPEARANCE AT NO EXTRA COST

Producto has engineered five important new design features into its master bushings*—the heart of the die set—which provide greatly improved accuracy and appearance *at no additional cost to users:*

1. NEW STANDARDS FOR RELIEF give greater bearing surfaces, improve accuracy. 2. GROUND SHOULDERS seat bushings square to punch holder, guaranteeing perfect alignment. 3. NEW GROUND LEAD ON PRESS FIT starts bushing into punch holder easily. 4. DOUBLE FIGURE 8 OIL GROOVES fed by grease fitting provide a constant source of lubrication to pin and bushing. (Optional spring-loaded grease cups are available.) 5. TUMBLE-BLASTING OF ALL UNGROUND SURFACES polishes surfaces in areas normally not finished after hardening.

These innovations are typical of the steps being taken to keep Producto's die set quality abreast of its service.

If you would like to receive *Die Set Digest,* our new, fact-filled quarterly, just drop us a note. And remember, for precision die sets fast, call your nearest Producto branch.

*"Popular size" master die sets already have these new bushings. They will soon be available on all sizes.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut
Telephone FOrest 7-8675

For prompt die set service, 'phone these PRODUCTO assembly warehouses:

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Cleveland	SU 1-6158	Los Angeles	TR 9826	St. Louis	FR 3370
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or check the Yellow Pages in any stamping center in the United States or Canada for distributors stocking PRODUCTO.

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4 STEPPED JAWS PERMIT CLAMPING of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Easy and quick to mount and align on any machine. Holds rigid in any position without vibration. Various capacities and extra soft jaws available.

Horizontal Swivel Type

Horizontal & Vertical Swivel Type

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Reversible safety tapping attachments with adjustable graduated friction drive, hardened, ground and lapped, complete with torque bar and handles. Precision made throughout by long established reputable West German factory.

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- Handy reversible switch conveniently located for quick flick of thumb.
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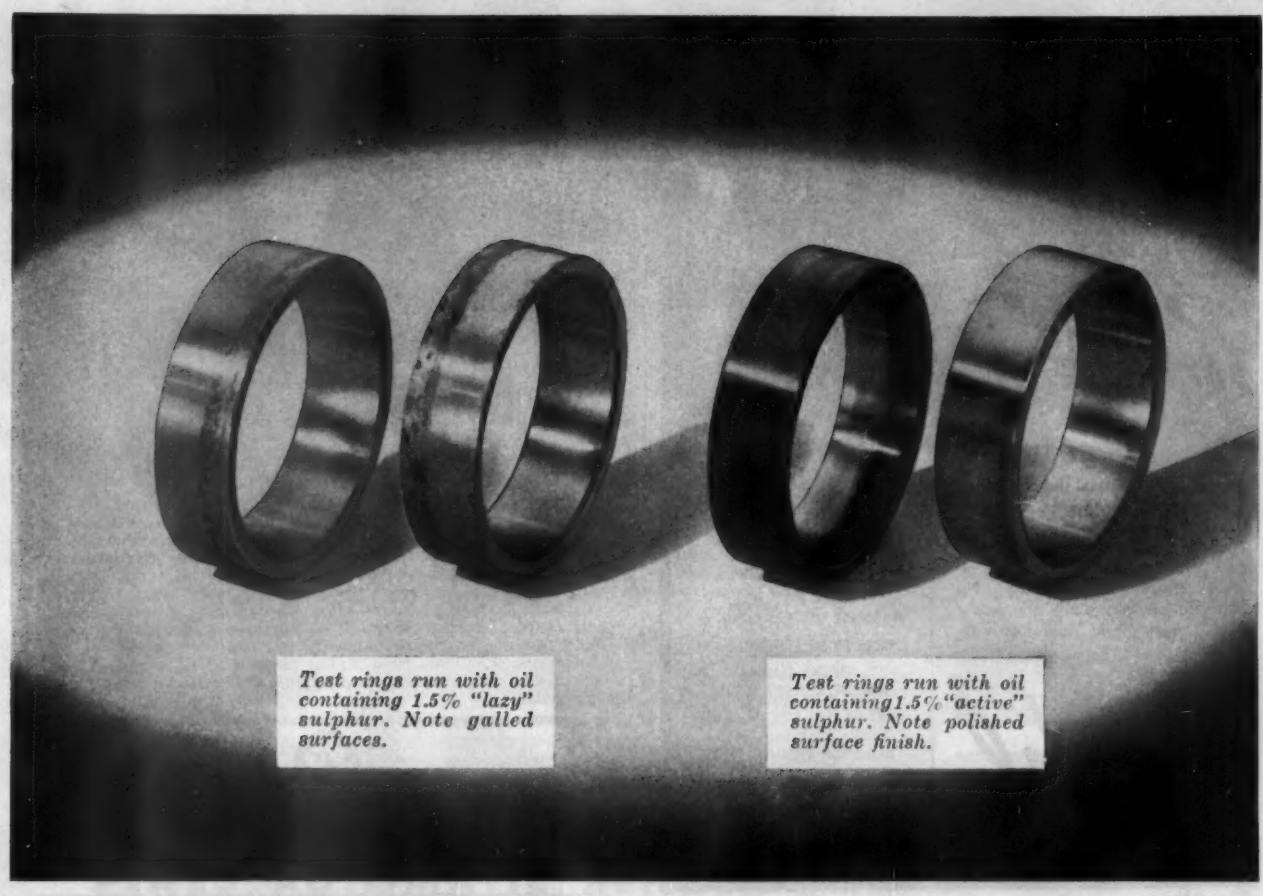

Test rings run with oil containing 1.5% "lazy" sulphur. Note galled surfaces.

Test rings run with oil containing 1.5% "active" sulphur. Note polished surface finish.

Only ACTIVE Sulphur Provides Fluid Lubrication Under Extreme Pressures

This comparative test proves it! Both tests were run on an SAE Lubricant Tester using two oils with the same percentage of sulphur. The specifications were similar—but look at the results!

The set of rings on the left were run with an oil containing "lazy" sulphur that did not provide the necessary anti-weld qualities. Under the heavy loads present in the test, the rings quickly galled and seized. The pair on the right were run with an oil containing "active" sulphur, the *only* type of sulphur that will prevent galling or seizure. It is performance that counts, not specifications.

"Active" sulphur in a cutting oil, readily reacts with the metal surfaces of the tool, chip and workpiece to produce metallic sulphide films that become fluid lubricants when sufficient heat is generated, and provide lubrication under the high temperatures that exist in the cutting orbit.

Stuart Oil Company's Shop Note Book, Bulletin S-2, contains further information on how to select a sulphurized cutting oil. Write for your copy today, and ask to have "the Man in the Barrel", your Stuart Representative, call too. He will help you select the cutting fluid that will provide the very best results under the conditions you will subject it to.

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Time Tested Cutting Fluids and Lubricants

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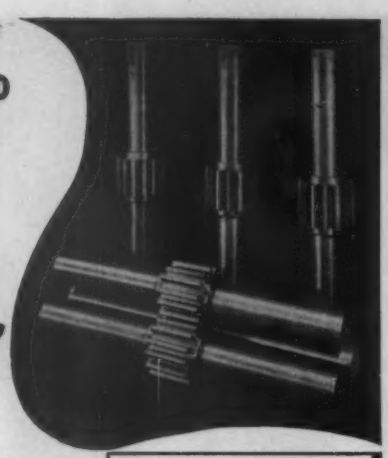
ALLOY FORGED STEEL SHAFT

Spur Pinions



The alloy forged steel shaft spur pinions illustrated were precision-made by Stahl for use on forging presses. Your own gear needs can be equally well met by availing yourself of Stahl's specialized experience. For gears of any material—any size—any quantity—get Stahl's estimate first!

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP
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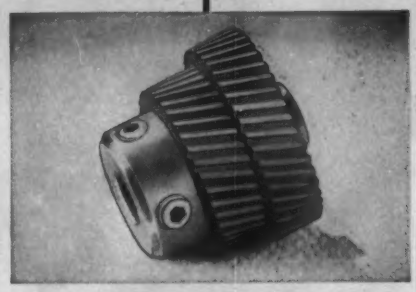
See How



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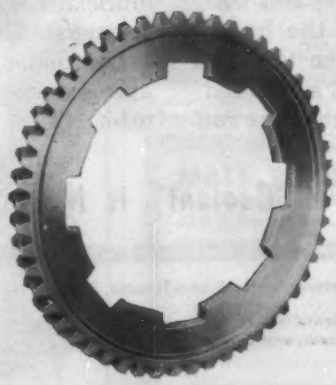

WORMS AND WORM GEARS
ALL TYPES AND ALL MATERIALS

BILGRAM
GEAR AND MACHINE WORKS
1217-35 Spring Garden
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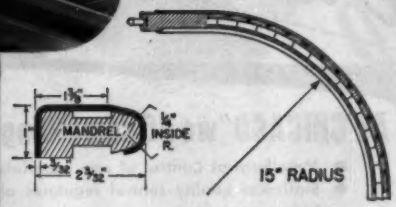
Over-all view of Pines Size 2 Automatic Bender in operation at Barber-Colman Company, Door Division, Rockford, Illinois.

Steel Channel Costs Cut 15% AT BARBER-COLMAN CO.



Position of mandrel and workpiece for making R.H. tracks.

L.H. track is formed with opening up.

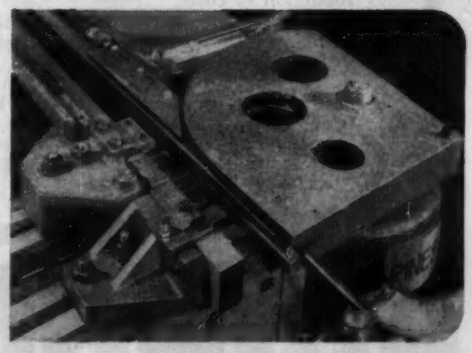
PINES AUTOMATIC BENDER

BOTH L.H. AND R.H. BENDS PRODUCED WITH SAME TOOLING

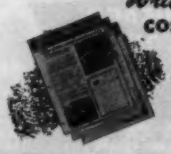
● Here's another outstanding example of how production bending the "Pines-Way" cuts costs . . . this time for Barber-Colman Company, leading manufacturer of top quality commercial and residential garage doors. By roll shaping door channels from flat stock, then cold bending in a Pines Size 2 Machine, costs have been reduced from 15% to 20%. Formerly, finished channels purchased in lots of 1,000 required extra storage space and a considerable inventory investment to meet the increased demand for "BARCOL" overhead doors. Today, the channels are easily produced as they are needed, which cuts inventory costs, reduces storage and handling problems, and improves delivery.

Smooth, Neat Bends Produced at Production Speeds

As illustrated, 90° bends are formed in HR 13-gauge (.094) steel channels on an inside radius of 15". Of special interest also is that both left and right-hand channels are formed with the same tooling. Smooth, neat bends are produced at production speeds without wrinkling or distorting. As shown in drawing, R.H. tracks are produced with opening down, and L.H. tracks with opening up, which eliminates swing of 8-foot leg. Change in angle specifications are met by the simple angle-of-bend settings on the machine. Setup and operation of machine is handled by semi-skilled machinists.



● Closeup of tooling used for making 90° bend for right-hand track. Flexible mandrel, inserted in channel, insures smooth, wrinkle-free bends. Bending arm speed is 6.0 r.p.m.



Write **FOR MORE DATA ON LATEST COST-CUTTING APPLICATIONS . . .**

If you would like up-to-date case-study data on production bending applied to steel channels, rods, extrusions, pipe or tubing jobs, write for free copies of "Pines News". Or ask for a Pines engineer to call and assist you with any tooling or production problem.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

672 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

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494

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The CHICAGO SCREW COMPANY
ESTABLISHED 1872
2505 Washington Boulevard
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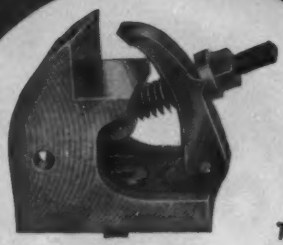
The complete Chicago "Safety Plus" line includes in alloy steel: Socket Set Screws • Socket Head Cap Screws • Socket Stripper Bolts • Square Head Dog Point Set Screws • Socket Pipe Plugs • Flat Head Socket Cap Screws • Dowel Pins • Hexagon Keys and Key Kits • Also Socket Set Screws and Socket Head Cap Screws in Stainless. The complete "Chicago" line of Standard Products includes: Hexagon Head Cap Screws in steel—bright and Grade 5, heat treated, also in brass and stainless • Square Head and Headless Set Screws • Taper Pins • Steel Studs Flat and Fillister Head Steel Cap Screws • Hexagon Nuts in steel, brass and stainless.

CUT SET-UP COSTS HUNDREDS OF WAYS WITH



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"Masters of A Thousand Set-ups"

Eliminate the need for many special expensive jigs and fixtures.

You will save time and money on most set-ups with Hart Milling Fixtures. They hold round, hexagonal, octagonal or square stock, for miller, shaper, drill press and tapper; they reduce set-up time and speed production. Hart Milling Fixtures are made in four useful sizes, and designed to be used in horizontal or vertical position. Let us send you full description and prices.

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39 Hayward St., Cambridge 42, Mass.

PRECISION DIES

CAN BE ENGRAVED BY ACROMARK SKILLED ENGRAVERS AND MODERN ENGRAVING EQUIPMENT.

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WE DO OUR OWN HEAT TREATING

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Stops Losses making Dies and Templates

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2301B North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301-B NORTH 11TH ST., ST. LOUIS 6, MO.

Will this blot spread... or shrink?

NOTHING STRIKES so brutally at human lives as a slum.

Yet of America's many millions of homes, the blot that is a slum covers more than 1 out of every 10 . . . and nearly one-half of all our homes are urgently in need of repair and basic improvements.

Will the blot go on spreading? Or will a concerted, nationwide attack on the causes of slums shrink it, year by year, until it is wiped out? Today, this is a challenge to every American . . . a challenge that *must* be met.

Your community . . . your problem!

A slum reaches across blocks, across miles, to sit on your doorstep and demand a price.

You pay it in the threat of crime and juvenile delinquency to your family. You pay the price in higher personal property taxes to fight the disease and crime and poverty that are slum-bred. You pay personally when the value of your home sinks as community deterioration takes another step closer.

Your *firm* pays when the community where you do business goes downhill. Slums automatically mean lower purchasing power and less effective labor.

Good citizenship is good business

It's good citizenship and good business both for your firm to join efforts to check housing decay . . . to stop slums before they start. In fact, it's the *responsibility* of every business, as it is of every other good citizen, to support community improvement efforts.

Some slums are beyond repair. They should be torn down and a fresh start made. Others can be remodeled, made to conform to better living standards. So it is up to you to get behind every sound program which seeks to provide adequate housing for all our people.

Adding your support to the efforts of the millions already attacking the problem, your firm can help stop slums cold and put America's housing standards at a new height.

How to get into action

A group of Americans from every walk of life has formed a new, non-profit organization to help combat home and community deterioration – The American Council To Improve Our Neighborhoods . . . A.C.T.I.O.N.

Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It also lists booklets, research reports, check-lists, and other material which can help you protect the housing health of your community. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American **C**ouncil **T**o **I**mprove **O**ur **N**eighborhoods

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

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The advertising rate is $12.60 per inch for all Business Opportunities & Equipment advertising appearing on other than a contract basis. Contract rates quoted on request.

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NEW ADVERTISEMENTS Address N.Y. Office, 330 W. 42 St., N.Y. for December 5th issue closing November 21st

Choice Business Opportunities

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ELECTRIC MOTOR SHOP, So. Calif. nr. Los Angeles. Many lg. accts. Netted $10,000 in 8 mot., 1955. Choice ind. loc. Other interests force sale at only: $5,000 plus inv. Dept. #22517

MACHINE COMPANY, W. Cen. No. Carolina. Fills specification orders, other mach. shop operations. Loc. in indust., textile center. Land inc. in sale, 2 bldgs. All types of equip. fully setup, new & in xlnt. condition. Best establ. machine comp. in this area. Ideal for one with machine know how, and ambitious. Priced nominally. Dept. #6685-A

MACHINE SHOP, Southern California in top coastal city, near Los Angeles. Nets $10,278 per year. Complete custom machine work. 3 large accounts. Ill health forces present owner to sell at only: $12,500 plus $350 inventory. Dept. #22520

MACHINE SHOP, W. Cen. Wash. Netted $9,042 last yr. w/sales higher this yr. Top franchises. Estab. 1918. Other interests force sale at low price. Terms. Dept. #22488

MACHINE TOOL CO., Meadville, Penn. Div. of Nat'l spring producer. Pittsburgh trade area. Fully equip. modern brick plant. Unlim. potential. Full Price: $12,000. Dept. #6830-A

MANUFACTURING CO., Lancaster, Pa. Mfgs. slips, gowns in nylon, tricot, cotton. 12,000 sq. ft. frame bldg. 5 rms, 2 offices. 5½ washrm. Space heaters. Fully equipd. Steady contracts. Dept. #6872-10M

STEEL FABRICATING CO., Los Angeles, Calif. area. Grosses $137,128 in 6 mo., 1955. Many impt. accts. Estab. in 1885. Handles steel fabrication, ornamental iron work, building decorations, etc. Compl. equip. Priced to sell. Terms. Dept. #22426

TOOL & DIE WORKS, Trenton, N. J. Reprod. any known tool for nat'l distrib. Loc. on R.R. siding. Fully equip. Seller will help establ. buyer. Net Profit '54: $10,600. F.P. only $30,000 inc. R.E. Dept. #6838-10M

WELDING & MACHINE SHOP, Cen. Texas. Blacksmithing, gen. repair work & welding of all types. Loc. in xlnt. industrial area, lg. trade area. Selling at a sacrifice price. Owner ill, must sell. Dept. #6803-A

FREE BULLETINS ON ABOVE BUSINESSES

CHAS. FORD & ASSOC.

6425 Hollywood Bl., Los Angeles, Cal.

87 Walton St., Atlanta, Ga.

OFFERED FOR SALE

Machine Tool Manufacturers of Turret Ram Type Vertical Miller Machine

We will sell patterns, jigs, fixture prints and all rights to manufacture our line of millers. Our line is well established throughout the United States by a great number of active dealers supplying more orders than we can take care of at present.

We find ourselves in the position to greatly expand our facilities or to sell out this machine line we manufacture.

FS-8297, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

CHIEF TOOL DESIGNER

Major producer of automatic turning and boring equipment has an unusual opportunity for capable tool design engineering executive to take charge of Tool Design Division. The company makes standard and special automatic equipment to customer specifications. These include specially designed holding fixtures, loading devices, transfer mechanisms, and tool holders utilizing the electrical, hydraulic, air and mechanical controls.

He will be responsible for final approval on all standard and special equipment produced. Must have thorough practical engineering design background in high production turning equipment. Jig and fixture experience alone is insufficient. Attractive salary. Splendid New England community. Utmost discretion assured interested individual.

P-8338, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

TOOL ENGINEER

START ABOUT $10,000

625 employees. Machining and Stamping Operations. Northern Indiana. Company aggressive and expanding. Definite opportunity.

RAY EDWARDS AND ASSOCIATES
28 E. Jackson—Webster 9-2905—Chicago

PEACOCK CORPORATION

Propane Gas Installations
and
Anhydrous Ammonia Plants

Paul E. Peacock, Jr., Pres.
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Large Machine and Weldment Capacity

Open capacity on 24 ft. and 10 ft. Vertical Boring Mills 7", 5" and 4" Horizontal Boring Mills; large radials and supporting small machines including new 2 AC Warner & Swasey automatic chucking. Especially interested in producing weldments requiring machining.

C. H. WHEELER MANUFACTURING CO.
Sedgley Ave. at 19th & Lehigh, Philadelphia 32, Pa.
Phone: Henry Kingston—Sagamore 2-8500

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For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us – we will take care of them.

GENERAL PATTERN WORKS
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REPLIES (Box No.) Address to office nearest you
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Machine Shop Assistant needed by medium sized heavy process machinery manufacturer. Young college engineer graduate with some experience preferred. Position has a future. First duties will cover rate setting, carbide tool development and assist in increasing productivity. Company has liberal profit sharing plan. Salary open. Location S.E. Penna. Reply P-7616, American Machinist.

Permanent position open for Assistant Maintenance Superintendent to assist supervision of all maintenance work in mine, mill, sinter plant and village of a large north eastern New York mining operation. Salary range $6,000 to $7,500 plus attractive salary benefits. Minimum 5 years experience required in supervision of mechanical and electrical maintenance work. Mechanical or electrical engineer preferable. Submit resume of experience, education and personal data to Box P-7876, American Machinist.

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Manufacturer of Horizontal Boring Mills of table, floor, planer and portable types with spindle diameters 3" to 5", has exclusive territories available throughout the country for well established machine tool dealers. Please state qualifications in first letter. Scharmann Machine Corporation, 337 Blvd. of Allies, Pittsburgh 22, Pa.

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Well established Cleveland firm of sales engineers, operating throughout northern Ohio, presently representing four nationally known machine tool manufacturers exclusively, open for one additional account. We offer considerable experience, versatility, and competence in sales engineering, with thorough knowledge and coverage of territory. Interested only in American quality line backed by good engineering and manufacturing facilities. Write RA-7934, American Machinist.

Successful machinery distributor with 4 full-time sales engineers in Detroit area needs additional high-production lines. No tool room machinery, accessories, or open lines desired. RA-8254, American Machinist.

FOR SALE

For Sale for $175. complete set of machinists' tools in perfect condition including 3 micrometers, inside and outside calipers, depth gauges, etc. Sam Huston, #344 South Wall Street, Kingston, N. Y.

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Used Duplex Milling Machine. Would prefer a Standard Width Standard speed Cincinnati Hydromatic Size 5-48, 5-60, or 56-72 Not older than 1942 in good working order give serial number.

The William KENNEDY & SONS, Limited
Owen Sound, Ontario—Canada

PRODUCTS WANTED
TO MANUFACTURE AND SELL

We are well-rated manufacturer with large facilities for all types of production (9 modern plants) and nationwide active sales-organization. We want additional products to manufacture and sell, consumer or industrial markets; low, medium or high unit-price. Specially but not exclusively interested in electrical-electronic items. We will complete engineering on new inventions. Protection guaranteed on unpatented models or ideas. Liberal royalties for right products.

Write Assistant to President

LION MANUFACTURING CORP.
2640 Belmont Ave., Chicago 18, Ill.

SAMSON
BUYS SELLS

STANDARD OR SPECIAL MACHINERY AND EQUIPMENT

FUNDS AVAILABLE
FOR PURCHASE OF SINGLE MACHINES OR COMPLETE PLANTS

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NO. 9 BUFFALO BILLET SHEAR

Capacity ½"x10" and ⅜"x11" Flat
Mild Steel Bar Stock

Not Over 10 Years Old

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Thread Grinder

Jones & Lamson late type thread grinder, 12" capacity, 36" centers, no more than five years old. Give Serial No., year built and asking price.

W-8228, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

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BORING MILLS, 84" King, 3 Hds., 1943
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3" Bar Universal, Tble. Type, Triway
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Nos. 2B Reid, 3B Abrasive, Surf.
36"x42" Pratt & Whitney Die & Surf.
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4'10" Col. Elek., New 1944
LATHES, 25"x192" Con. L. & S., T.A., Late
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DeVLIEG No. 3-A, 3" bar Jigmil; late
EX-CELL-O #12-C Single End Double Spindle; late
EX-CELL-O No. 2112 single end, double spindle; late
GIDDINGS & LEWIS 340-T; 4" bar; late type
HEALD No. 47-A single end Bore-matic; late
HEALD No. 49 double end Bore-Matic; latest
LANDIS No. 35, 3½" Floor Type, motor drive
NILES 8" bar; floor type; motor drive
SELLERS 5" bar Table Type; late type

BORING MILLS—Vertical

BULLARD 8', 8-spindle Type "D" Mult-au-matic
BULLARD, 16", 6-spdl. Type"D" Mult-au-matic; late
BULLARD 30" high speed 18" extra high column
BULLARD 36", vertical turret spiral drive, late
CINCINNATI 54" "Hypro"; PRT; late type
NILES 36-44" Vertical Turret Lathe; late type
NILES 100" Heavy Duty Vertical; PRT, late
SELLERS 144", 2-swivel heads on cross rail; power rapid traverse, motor drive

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BROWN & SHARPE No. 2; Univ.; late
BROWN & SHARPE No. 4 Universal 14"x60"; late
CINCINNATI 14"x72"; Universal; Model ER; late
HARTEX 16"x60" Univ., model RHU-1520; New 1953
LANDIS 4"x12" Type "H" Hyd., Plain; late
LANDIS 10"x18" type "C" Plain; hydraulic
LANDIS 10"x36" Plain; motor drive
LANDIS 10"x36" type DC pl. hyd., infeed; m.d., late
LANDIS 16"x36" Type "C" Universal; late
LANDIS 20"x144" Plain Cylindrical Gap; M.D.
LANDIS "D" 25"x72" Crank Pin Grinder; late
LANDIS "C" 16"x72" Plain; late type
LANDIS type "DCP" 16"x72" hydr., late type
NORTON 4"x12" model CTU Plain; new 1953
NORTON 6"x18" Type "C" Plain Cyl.; late
NORTON 10"x30" Plain; motor drive
NORTON 10"x48" Type "C" Hydr., Plain, Cyl.
NORTON 6/10"x18" Plain, Cylindrical; late
NORTON 16/26"x72" Plain, Cylindrical; late

LATHES—Engine and Mfg.

BRIDGEFORD 48"x10' Geared Head Lathe
GISHOLT No. 12 Hydraulic Automatic Chucker; late
HENDEY 16/24"x30" centers; Timken; late
HENDEY 24"x36" centers, M.D.; late type
JONES & LAMSON "FAY" 9" Auto. Timken; late
JONES & LAMSON "Fay" 20"x25" Auto., M.D.
LeBLOND Model 7ACL Crankshaft; 9"x30"; M.D.
LeBLOND 20"x48" centers; H.D. Timken; late
LeBLOND 27"x144" centers; motor drive
LODGE & SHIPLEY No. 3-A Duomatic; late
LODGE & SHIPLEY No. 5, 24" & 96" centers; DUOMATIC; Timken; late
LODGE & SHIPLEY 12"x30" G.H. Toolroom; late
LODGE & SHIPLEY 14"x30" Centers; late type
LODGE & SHIPLEY 16/20"x54", 18/22"x54" Toolroom; Timken; late
LODGE & SHIPLEY 18"x30", 18"x54"; Timken; latest
LODGE & SHIPLEY 20"x48", 20"x144"; Timken; late
LODGE & SHIPLEY 20"x54" Gap; Timken; late
LODGE & SHIPLEY 22"x48", 22"x96"; Eng., Timken
LODGE & SHIPLEY 24"x48"; Timken; latest
LODGE & SHIPLEY 24"x96"; Timken; late type
LeBLOND 4"x60", 4"x84", 5"x168" centers, late type
MONARCH 18"x48" Model CBB; late type
MONARCH 14"x54" centers; model AA; late
MONARCH 20"x144" centers; Model CM; (raises to Swing 31"); New 1947; late type
MONARCH 22"x264", 22"x336" cc. Model M; late type
MONARCH 12"x30" model "KK" Eng., Timken; late
MONARCH 24"x60" model "M", Timken; late
MONARCH 24/36"x48" model "N", air traser; 60 series; late type
MONARCH 16"x30" model "C", Timken; late type
MONARCH: 18"x48" "CBB" (raises to 26½"); Timken; late type
MONARCH 16"x72" "BB" (raises to 26"); Timk.; late
NEW HAVEN 42"x120" centers geared; M.D.
NILES 30"x25', 30"x40' bed, Sgle. End Ber., "Timken"
NILES 30"x100" centers "Time Saver"; Timken
NILES 36"x100" c.c. "Time Saver"; late type
NILES 42"x216" centers Geared Head; late
PRATT & WHITNEY 16"x30" c.c.; Timken; late
SPRINGFIELD 14"x43" geared; M.D., late type
SPRINGFIELD 20"x48" centers, Timken; late
SUNDSTRAND 8"x15" Auto mfg., late type
SUNDSTRAND 10"x60" centers, Automatic; late
SUNDSTRAND 12"x22" Automatic; late type

LATHES, Turret

GISHOLT 1L, 2L Univ. Saddel type; Timken; late
GISHOLT No. 3; No. 5 Univ. Ram Type; Timken; late
LIBBY 1H6, 6" hole, long bed; late
LIBRY 4H-12" hole, M.D. Turret Lathe; M.D.
MAGDEBURG model MWF-250 Universal; late
MOREY No. 2 ram type, Timken; latest type
MOREY No. 4 ram type; Full Univ.; latest
POTTER & JOHNSTON No. 4D Auto. H.S., Timken; late
POTTER & JOHNSTON No. 4D-S model "FC"; No. 4D-S H.S.
POTTER & JOHNSTON No. 8DT Automatic Chucking & turning; late type
WARNER & SWASEY #1 "Electric", M.D., late
WARNER & SWASEY No. 2 Ram type; Timken; late
WARNER & SWASEY #1A; 3, 4, 4-A; Univ. Ram Type; late
WARNER & SWASEY No. 4, No. 5, Univ., preselector head, late

MILLERS, Profile and DUPLICATING MACHINES

CINCINNATI 5-60 hydr., tracer control; late
PRATT & WHITNEY 30", 2-spindle; late type
PRATT & WHITNEY "Keller" model GG 1210; latest

PLANERS

GRAY 48"x48"x10' "Maximum Service"; 4 heads; Power Rapid Traverse; D.C. Reversing; M.D.
LIBERTY 144"x78"x49' adj. openside; box table; 4 hds.; vari-voltage; Power Rapid Traverse; M.D., late type; NEW 1940
NILES 48"x48"x10' double, 4 heads, PRT; M.D.
NILES BEMENT POND 72"x72"x30'; 4 hds.; Power Rapid Traverse; D.C.; M.D.
POND 60"x60"x14' double housing; late type
SOUTHWARK No. 1, 16' Plate Edge Planer; late

PRESSES

BESCO Model M18; OBI; cap. 10 tons; New
BESCO Model EB2, 18½-ton Back Flywheel; New
BESCO Model EB4, 40-ton cap. Back flywheel; New
BIRDSBORO 325-ton, 31"x31" bet. uprights, hydr.
BLISS No. 410A, 525-ton double action toggle drawing press; M.D.
METALWOOD No. 35A Univ. Arbor & Forcing Press
NATIONAL No. 5 "Maxi-Press" 1,000 ton cap., H.S. Forging Machine; M.D.
NIAGARA No. 66E, 35-ton Press; late type
ROGERS 150 ton Shop Press; latest type
V & O 30-ton O.B.I. Press; late type
WATERBURY FARRELL No. 9, 125-ton cap. Blanking Press; M.D.
WATSON STILLMAN 150-ton Horiz. Hydr. hand operated Wheel Press

*PARTIAL LIST. Ask for catalog!

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MANUFACTURERS • MERCHANTS • DISTRIBUTORS of MACHINE TOOLS
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Serving the World's Largest Manufacturers

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MACHINERY

FOR SALE

OUTSIDE OVERHEAD CRANE AND CRANE RUNWAY. Crane 20 ton capacity—45' span, 230 volt DC motors and cab control.

Runway 120' long, 45' wide, 18' under hook. Now dismantled and ready for shipment. Priced right for quick sale.

MONA MOTORS

HAZARD BROWNELL MACHINE TOOLS INC.
350 WATERMAN STREET PROVIDENCE 6, R. I. DEXTER 1-8880

No. 4 B & S Automatic, M.D.
Fosdick 4-spin. No. 5BMA Drill.
Gleason 3" Str. Bevel Gear Gen.
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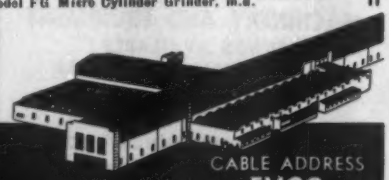

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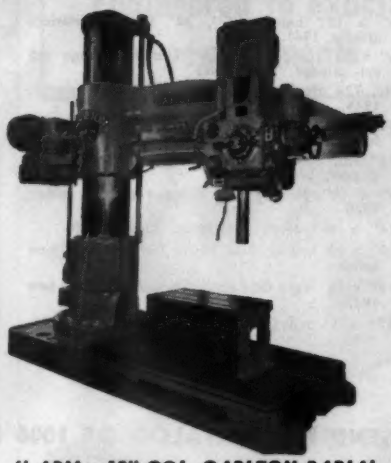

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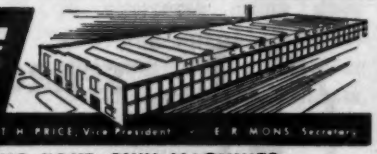

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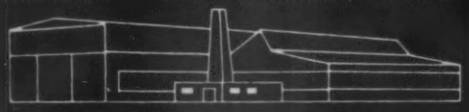

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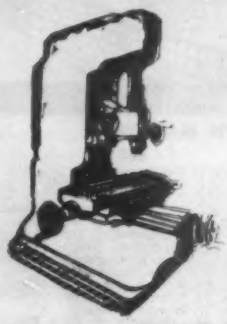

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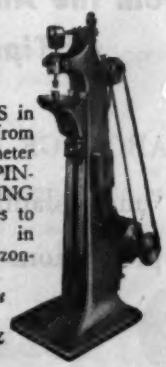

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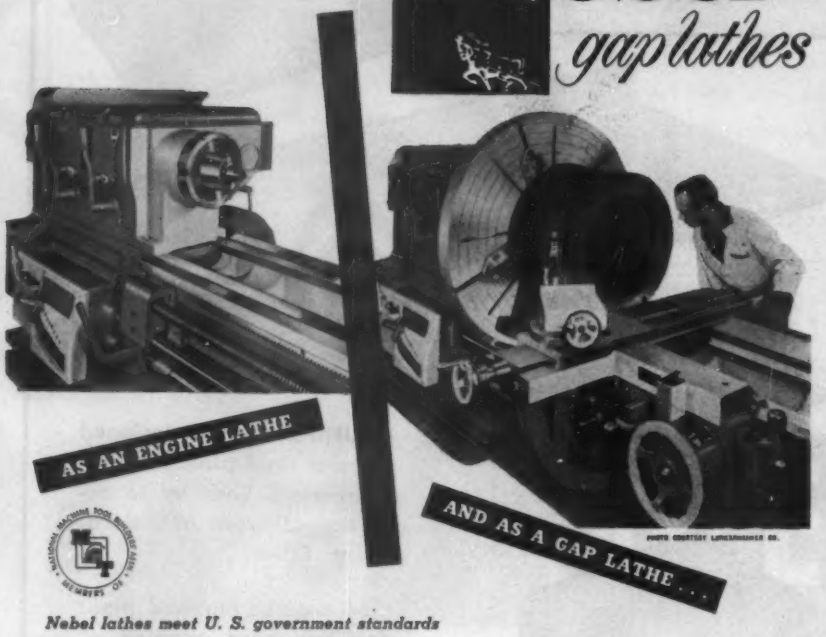

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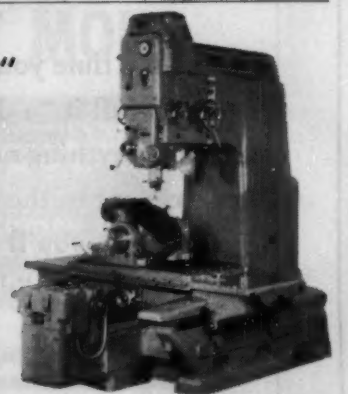

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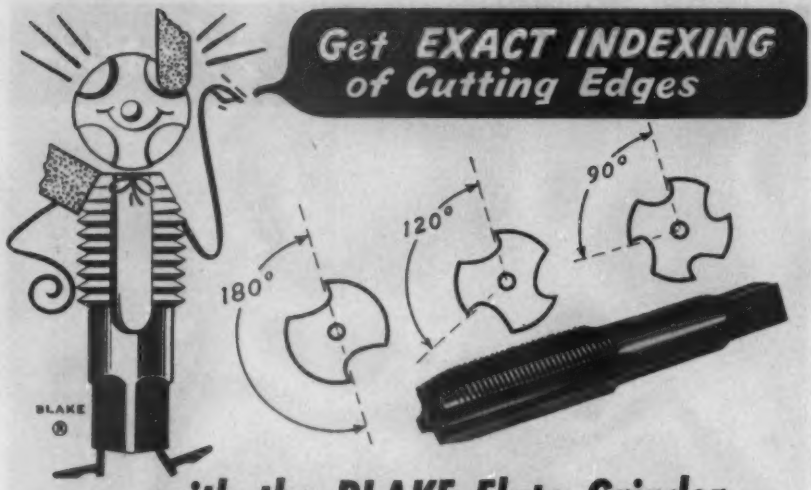

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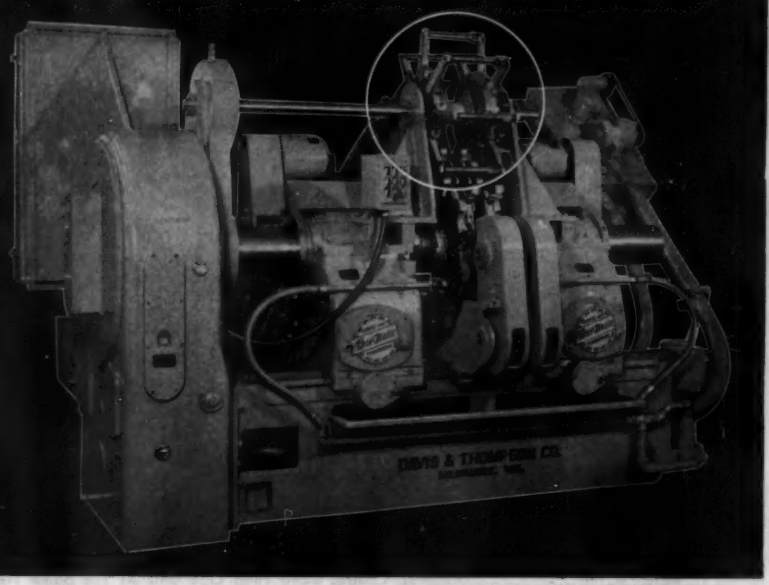

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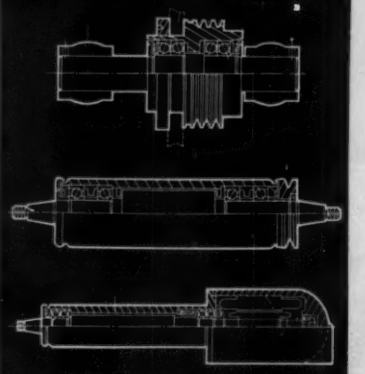

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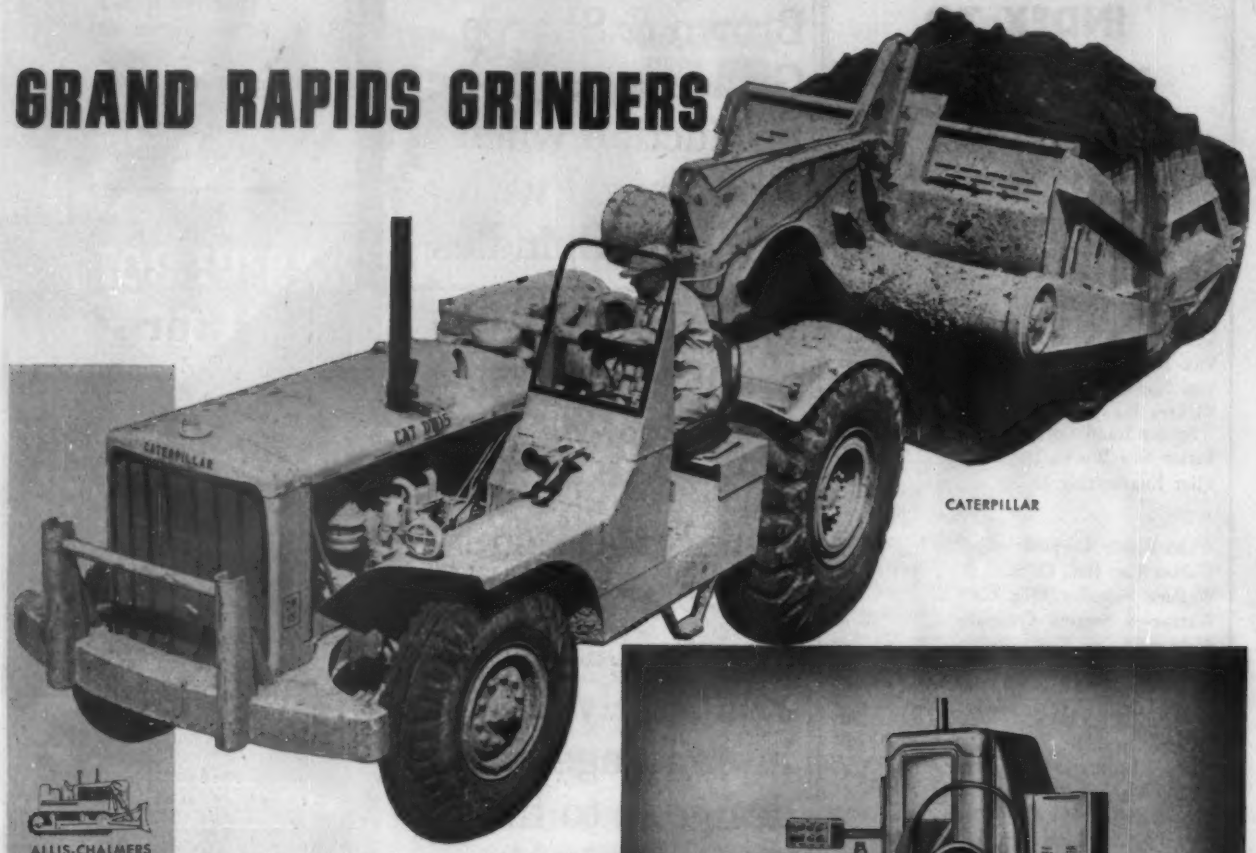

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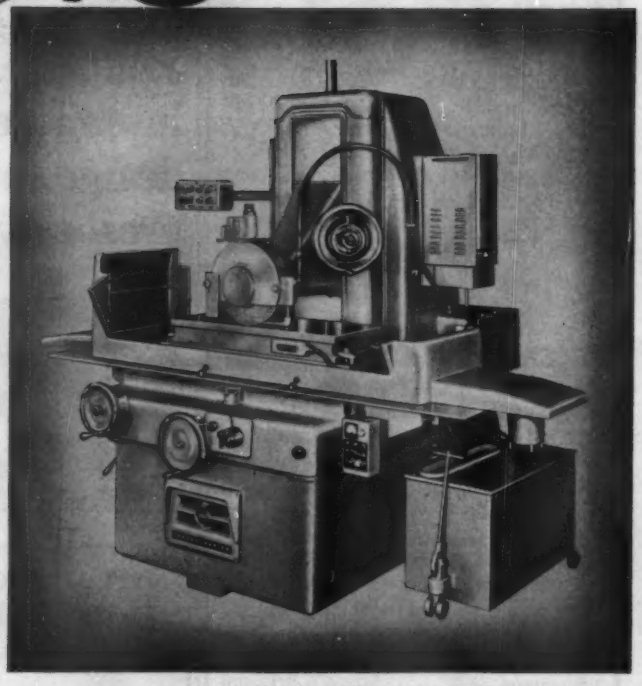
MASSEY-HARRIS-FERGUSON

The makers of these famous tractors and allied heavy-duty equipment use Grand Rapids Grinders in their toolrooms. In fact, you'll find Grand Rapids Grinders wherever manufacturers place a premium on precision . . . because they're designed and built for lifetime precision grinding.

Take our Model 560, shown at right. Its column and base are a massive, one-piece casting for permanent, rigid alignment. Wheel head has powered rapid vertical travel; cross feed and longitudinal travel table are hydraulically actuated. Table speed is variable up to 140 fpm, making this the *fastest* grinder of its type and size!

If you're not already enjoying these standout features in your toolroom, a note on your letterhead will bring full details.



GRAND RAPIDS NO. 560 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 140 fpm. Working surface of table is 14" x 36". Vertical movement of wheel head is 18". Pre-loaded ball bearing spindle greased for life. Spindle speeds 1800 and 2140 rpm.

GALLMEYER & LIVINGSTON

Write for full information.

GALLMEYER & LIVINGSTON CO. 430 STRAIGHT AVE., S.W. GRAND RAPIDS, MICHIGAN

purred along smoothly in high gear all year long. Each inquiry was quoted on or acknowledged by telegram the same day it came in.

ONE and TEN-PAKS to slash distributor's Broken-Package problem, manufacturer's handling costs.

THE PRE-PAK PLAN for a new and revolutionary approach to cutting handling costs.

NEW BOXES, sturdier cases, improved labels to assist everyone who handles Holo-Krome products.

SLIDING SHELVES to speed orders through our own plant and give you better service.

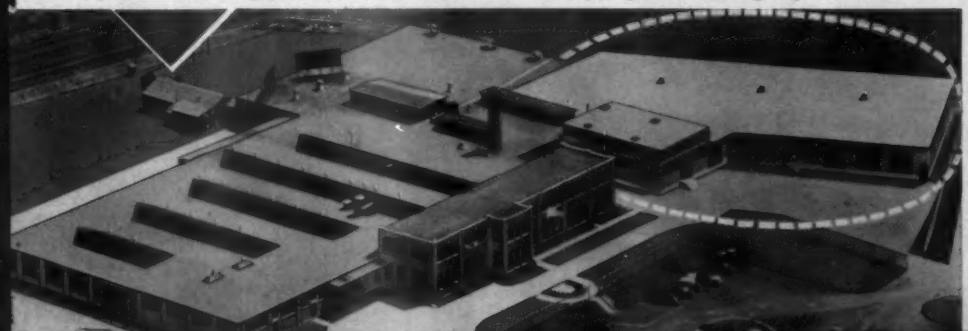
WHAT A YEAR WE'VE HAD AT HOLO-KROME!

Seems like every time we turned around someone came up with a new idea on service, packaging or products to help our distributors and their customers

BUT '55 WAS NOTHING—WATCH '56! GREAT THINGS ARE HAPPENING AT— HOLO-KROME

THE HOLO-KROME SCREW CORP., 25 BROOK ST. • HARTFORD 10, CONN.

NEW PLANT WING and new equipment to meet the increasing demand for H-K products . . . bring you even better service from our shipping and receiving departments.



Machines high-precision bearing races in 30 to 60 seconds

with TIMKEN® bearings on the spindle

THIS Acme-Gridley CHUCK-MATIC machines the races of high-precision bearings from 4″ to 8″ in diameter. And it does it in 30 to 60 seconds, operating at speeds and feeds as fast as carbide tools can take. The spindle bearings must have high precision. And must keep that precision at high speeds, under heavy combination loads. That's why National Acme specified Timken® precision bearings for the spindle.

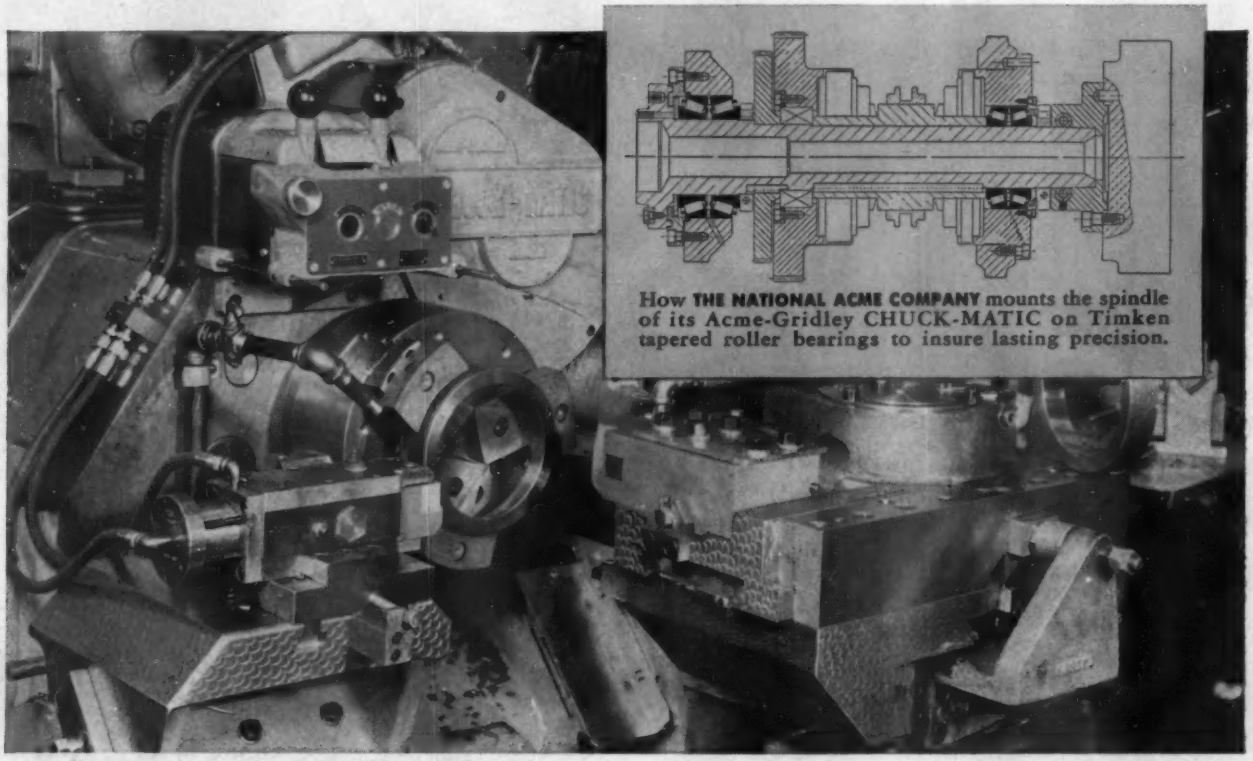
The tapered design of Timken bearings lets them take radial and thrust loads in any combination. The spindle is held in rigid alignment. End play is eliminated. These factors plus the extreme accuracy of Timken bearings assure precision machining at all times.

Full line contact between the rollers and races of Timken bearings gives them extra capacity to carry the loads of the heavy, high-speed cuts. And since Timken bearings on the spindle normally last the life of the CHUCK-MATIC itself, maintenance is reduced.

Power is saved in the CHUCK-MATIC because Timken bearings practically eliminate friction. They are geometrically designed to give true rolling motion and they are precision manufactured to live up to their design. And to get the quality of steel to meet our exacting specifications, we make our own. No other U. S. bearing manufacturer takes this extra quality control.

Specify Timken bearings for the machinery you build or buy. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **THE NATIONAL ACME COMPANY** mounts the spindle of its Acme-Gridley CHUCK-MATIC on Timken tapered roller bearings to insure lasting precision.

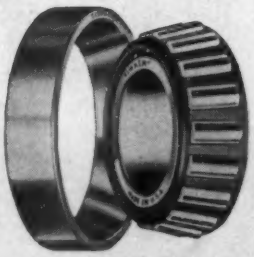
REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization; 2) standardizing on 13 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, production costs can drop still further, meaning even lower costs to you.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬯ AND THRUST →⬯← LOADS OR ANY COMBINATION →✳←